SOIL SURVEY

Clark County Ohio

Series 1949, No.1

Issued July 1958

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
OHIO AGRICULTURAL EXPERIMENT STATION

How to Use THE SOIL SURVEY REPORT

THIS report is about the soils of Clark County, Ohio. It describes each kind of soil in the county and tells how you can use it, how to take care of it, and what yields you can expect. The soil map shows the location and extent of each kind of soil.

SOILS OF A FARM

If you are a farmer or if you work with farmers, you probably want to know about the soils of a farm or small tract. First find the right place on the soil map. The map shows township and section lines, towns and villages, roads, streams, most of the houses in rural areas, and other landmarks. Remember that an inch on the map is 2.64 miles on the ground.

Each kind of soil is marked on the map by a symbol made up of two letters; for example, the symbol Bk identifies Bellefontaine silt loam, undulating phase. On the margin of one of the map sheets are printed the names of all the soils mapped in Clark County, the symbols that identify them, and the color in which each is shown on the map. Look up the symbols in the map legend to find the names of your soils. Then you can refer to the soil description in the report.

Suggestions for managing each soil are contained in the section, Use and Management of Soils. Yields that you can expect from common crops are shown in table 5.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils is given in the section on soil associations. This section tells about the major kinds of soils and the patterns in which they occur. When reading this section, refer to the soil association map (fig. 2). The patterns shown on this map frequently indicate well-defined differences in the type of farming, land use, and land use problems.

A newcomer to the county, especially if he considers buying land, will want to know about the climate; types and sizes of farms; principal farm products and how they are marketed; kinds and conditions of farm tenure; availability of water, roads, and railroads; and location of towns and population centers. Information about these will be found in the section, General Nature of the Area.

This publication on the soil survey of Clark County, Ohio, is a cooperative contribution from the—

SOIL CONSERVATION SERVICE

and the

OHIO AGRICULTURAL EXPERIMENT STATION

Series 1949, No. 1 Issued July 1958

SOIL SURVEY OF CLARK COUNTY, OHIO

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United States Department of Agriculture in cooperation with the Ohio Agricultural Experiment Station.

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[1] At time of survey (1946–48), the Division of Soil Survey was part of the Bureau of Plant Industry, Soils, and Agricultural Engineering. It was transferred to the Soil Conservation Service on November 15, 1952.

CLARK COUNTY, which covers approximately 400 square miles of west-central Ohio, in the valleys of the Little Miami and Mad Rivers, is primarily agricultural. More than 86 percent of its area is in farms. Livestock, principally hogs, is the major source of farm income. Good yields of corn, wheat, hay, and white potatoes are produced where the soils are suitable for crops and are well managed. Crop yields, and consequently the number of animals that can be raised could, in almost every part of the county, be increased by additional fertilization, crop rotation, erosion control, or proper drainage. To provide a basis for the best agricultural use of the land a cooperative soil survey was made by the United States Department of Agriculture and the Ohio Agricultural Experiment Station. Field work was completed in 1949. Unless otherwise specifically indicated, all statements in this report refer to conditions in the county at that time.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Clark County, in the west-central part of Ohio, covers approximately 400 square miles, or 257,305 acres. It is bounded on the north by Champaign County, on the west by Miami County and a part of Montgomery County, on the south by Greene County, and on the east and part of the south by Madison County (fig. 1).

Springfield, the county seat and largest town, is on United States Highway 40 near the center of the county, close enough to both Columbus and Dayton to feel the trade influence of those cities. Springfield is highly industrialized and is the natural center of trade for the county.

SETTLEMENT AND DEVELOPMENT OF THE COUNTY

Clark County was organized on March 1, 1818, from parts of Champaign, Madison, and Greene Counties (*7*).[2] It was named for Gen. George Rogers Clark of Revolutionary War fame. The city of Springfield, county seat since the county's organization, was incorporated in 1827.

According to the original surveys of the United States public lands (*6*), the area now in Clark County once included parts of the Virginia Military Tract, the Symmes Purchase, and the Congress Lands of Ohio. The Congress Lands and Symmes Purchase Lands were surveyed in mile-square sections; the Virginia Military Lands were not

[2] Italic numbers in parenthesis refer to Literature Cited, p. 139.

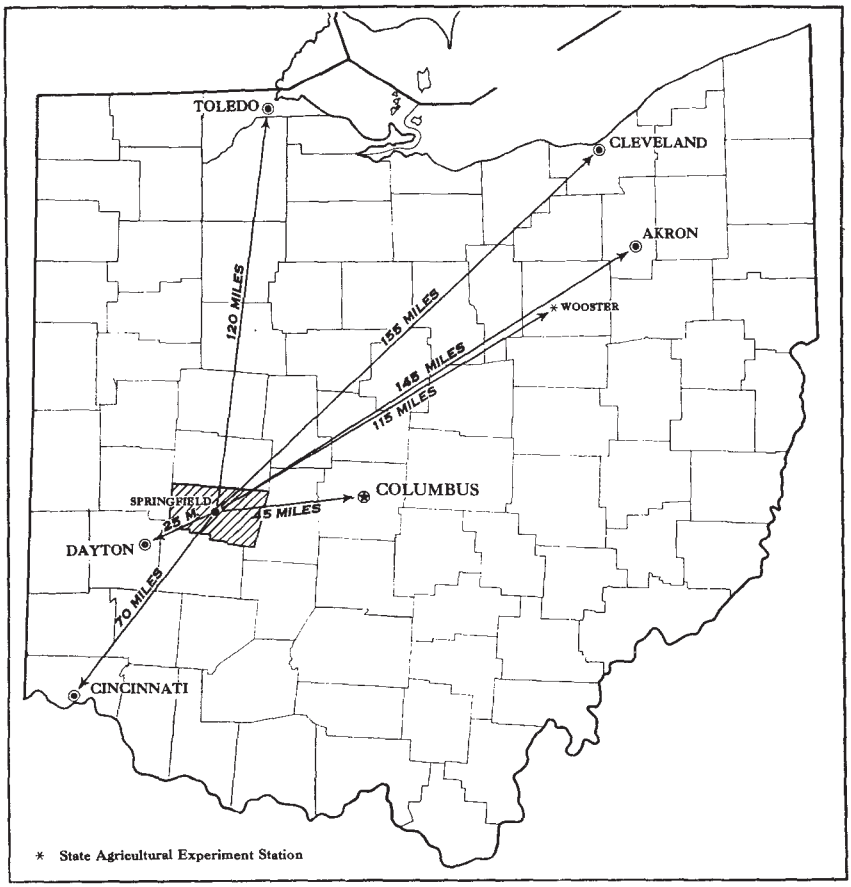

FIGURE 1.—Location of Clark County in Ohio.

sectionalized but surveyed by the metes and bounds method.

Before the first white settlers arrived, the county was part of the territory of the Shawnee Indians. The region was known as the Ohio Country, and for many years the French, British, and Indians contested for ownership.

Settlement was particularly rapid between 1795 and 1808. The early settlers came largely from Virginia, Pennsylvania, New Jersey, and New England. They were mainly of English, German, and Scotch-Irish ancestry. Most of the present rural population is made up of descendants of the early settlers.

According to the 1950 census, the population of the county was 111,661, of which 82,284 was urban (nearly all in Springfield) and 29,377 was rural. Population is fairly evenly distributed, but somewhat heavier near towns and trading centers, and apparently somewhat influenced by proximity to railroads, by land prices, and by the nature and lay of the land. Normally, the best agricultural soils are the most sparsely populated. Springfield, the county seat, is a highly industrialized city.

At the time of the survey, Clark County was served by lines of the New York Central System, the Pennsylvania Railroad, the Erie Railroad, and the Detroit, Toledo and Ironton Railroad.

The county is crossed by Federal highways 40, 42, and 68, and by several paved State highways. County and township roads, some gravelled but most of them paved, reach all communities and homes.

Local and transcontinental buses serve most of the principal towns. Many trucking companies haul freight on regular schedules between traffic centers. Springfield has a modern municipal airport.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

Clark County is entirely within the Till Plains section of the Central Lowland physiographic province. Its present topography and drainage pattern were formed largely by glacial action. The ice sheets scoured away hilltops and filled valleys with glacial debris. When the glaciers melted and retreated, the glacial drift they left formed knobby hills and hummocky ridges along the moraines and level plains between the moraines.

Physiography.—The land surfaces of the county fall into five general divisions: (1) level flood plains and low outwash terraces of the stream valleys; (2) slightly higher, level to gently undulating benches or outwash deposits of the glacial valleys; (3) rolling to steep valley walls, produced either by stream dissection or constructive morainal deposits; (4) predominantly undulating divides of the general upland level (mainly on the till plains); and (5) recessional or end moraines and kames (pl. 1) that protrude above the general upland level.

Relief.—In general, the slope pattern is complex in the uplands and uniform and simple along the larger drainageways. Relief ranges from level to steep but is predominantly undulating. Level areas occur principally on stream flood plains, outwash plains, valley trains and terraces, and in upland depressions and flats, particularly on the till plains. Hilly to steep areas occur most extensively along the valley walls of the major drainageways and in the moraines. These hilly to steep areas are in Pleasant and Moorefield Townships, in the northern and eastern parts of Springfield Township, and in the southeastern part of Mad River Township. Along the west wall of Mad River valley, between the Champaign County line and United States Highway 40 and for some distance westward, the topography is rough and steep and has apparently been formed in part by erosion that has taken place since the last glaciation. Otherwise, the topography of the county is essentially the same as when the Late Wisconsin ice sheet retreated.

The upland is about 1,000 to 1,100[3] feet above sea level; it slopes gently to the southwest. The highest elevation in the county, about 1,250 feet, occurs about 2 miles northeast of Catawba near the Champaign County line. The lowest, 820 feet, is in the southwestern corner where the Mad River crosses the county line.

Drainage.—All the streams in Clark County, except the North Fork, flow into the Little Miami River or the North Fork Little Miami River,

[3] Elevations from U. S. Geological Survey topographic sheets for Clark County, Ohio.

both of which empty into the Ohio River. The North Fork empties into the Scioto River, southeast of the county. The Mad River, the master stream of the main drainage system, enters the county just west of Bowlusville on the Champaign County line and flows diagonally to the southwestern corner. The Little Miami River heads in the county, about 3½ miles northeast of South Charleston, and leaves the county about 1 mile east of Clifton.

The larger streams have cut down through the glacial drift to bedrock, but only in their lower courses. The Mad River strikes limestone bedrock near Springfield; from that point downstream the boundaries of the river valley are well-marked by steep limestone walls (*4*). Buck Creek first cuts into the limestone at Lagonda, in the city of Springfield. The Little Miami River has cut a narrow gorge through the limestone at Clifton.

GEOLOGY[4]

Preglacially, the topography and drainage of Clark County were mature; the uplands were fairly well dissected and the stream valleys were moderately cut. Glaciation affected the topography in different ways, depending upon the balance between the rate at which the glacier moved south and the rate at which the ice melted at the southern edge.

Recessional moraines.—Where the rate of melting about equaled the rate of the forward movement of the ice, glacial debris piled up to form rolling to hilly hummocks known as recessional moraines. These formations are normally continuous along their long axes but are occasionally broken or isolated.

Ground moraines.—Between the recessional moraines are relatively broad, undulating to almost level plains called ground moraines or till plains. These were formed when the melting of the ice was much more rapid than its forward movement. The glaciers withdrew uniformly, leaving a thoroughly mixed mass of stone flour, clay, pebbles, and gravel, called glacial till.

Outwash plains and valley trains.—During warm periods, rapid melting of the glaciers created great floods, which spread out in the lowlands to form large rivers. Many of these rivers were several miles wide near the edge of the ice in warm seasons; during colder seasons they diminished or disappeared. The waters from the melting ice carried large quantities of materials ranging in size from the finest clays to large cobblestones. Cobblestones, pebbles, and coarse sands were deposited in swift water, finer sands in more slowly moving water, and silts and clays in the relatively quiet waters of temporary lakes or ponded areas. All of these deposits are known as outwash plains and valley trains. In Clark County they consist mostly of well-assorted stratified sands and gravel. The deposits laid down by flowing glacial waters are *glaciofluvial* deposits; those laid down in temporary lakes and ponded areas are *lacustrine* deposits.

All glacial deposits, whether laid down by ice or glacial water, are known collectively as *glacial drift.*

[4] Basic information for this section obtained from the following: Report on Water Supply in Clark County (*2*); Soil Survey of Fulton County, Indiana (*5*); Soil Survey of Miami County, Ohio; and information from R. P. Goldthwait, Dept. of Geol., Ohio State Univ.

GLACIAL HISTORY

Clark County has been affected by four periods of glaciation. The first of the glaciers, the Kansan or pre-Kansan, did not extend south as far as Clark County, but it dammed up the preglacial Teays River to the northwest and caused the drainage flow to shift from northwest to southwest. Apparently, the drainage pattern was not materially altered by succeeding glaciations.

After the Kansan ice sheet receded, there was a long period marked by no surface disturbances except stream entrenchment.

The first ice sheet that covered Clark County was the Illinoian; it was followed by the Early Wisconsin and the Late Wisconsin. These glaciers destroyed all higher forms of life in their path; they pulverized rock and other material, and carried some rocks hundreds of miles and deposited them far from their sources.

After the recession of the Late Wisconsin ice sheet, Clark County was covered by glacial drift ranging from a few feet to more than a hundred feet thick. This mantle of glacial drift, from which the soils of the county have developed, was derived to a large extent from the Niagara dolomites that underlie most of the county, and to a lesser extent from calcareous shales and limestone. Formations over which the glacier passed, north and west of Clark County, have also contributed to the glacial drift. These formations are Monroe dolomite; Columbus limestone; Ohio shale; and crystalline rocks, such as granite and quartzite, from the Canadian highland. Most of the large boulders in the drift are granite or quartzite, which are resistant to weathering.

The extensive moraines and valley trains of this region were produced chiefly by two lobes of the Late Wisconsin ice sheet. A highland in Logan County, north of Clark County, caused the advancing ice mass to separate into two distinct lobes. One lobe, the Scioto, advanced into Clark County from the northeast, through the preglacial Scioto Valley; the other, the Miami, came from the northwest, through the preglacial Miami Valley.

Apparently, the two lobes came together in Clark County. Then each receded in the direction from which it had advanced and left recessional moraines having north-south axes rather than the more usual east-west axes. The Scioto lobe left five recessional moraines, which mark five different positions of the ice front. These five moraines merged in eastern Clark County and western Madison County. They formed a heavy concentration of morainic materials, mostly unassorted till or gravel and sand. In the eastern part of the Scioto lobe (from the Reesville moraine eastward), the soils derived from glacial till are shallower to lime, have heavier textured B_2 horizons, and are apparently younger than are comparable soils elsewhere in the county.

The Miami lobe left two distinct moraine belts. Its morainic materials are mainly unassorted till. In places, however, the material is stratified sand and gravel, which may be exposed at the surface.

CLIMATE

The climate of Clark County is temperate, humid, and continental. Summers are generally hot and humid; winters are cold but not

extreme. The average annual rainfall is about 38 inches. Temperatures are fairly uniform throughout the county. Table 1 gives climate data recorded at Dayton, Ohio.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Dayton, Montgomery County, Ohio*

[ELEVATION, 745 FEET]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year	Average snowfall
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	32. 7	65	−8	2. 55	1. 32	2. 22	3. 7
January	29. 6	67	−16	2. 48	1. 39	9. 81	7. 3
February	31. 4	69	−9	3. 87	1. 07	5. 02	4. 4
Winter	31. 2	69	−16	8. 90	3. 78	17. 05	15. 4
March	42. 2	84	5	3. 58	2. 98	2. 56	2. 7
April	51. 5	89	22	3. 91	. 95	4. 32	. 9
May	63. 4	92	31	4. 20	. 90	2. 87	[3]
Spring	52. 3	92	5	11. 69	4. 83	9. 75	3. 6
June	72. 9	98	40	3. 27	3. 45	4. 34	0
July	76. 4	101	49	3. 23	2. 14	2. 54	0
August	74. 9	103	42	2. 78	3. 47	5. 74	0
Summer	74. 7	103	40	9. 28	9. 06	12. 62	0
September	67. 2	98	34	2. 29	4. 09	4. 81	. 2
October	56. 7	89	21	2. 95	. 15	2. 55	1. 3
November	42. 9	76	0	2. 43	1. 83	4. 81	3. 7
Fall	55. 6	98	0	7. 67	6. 07	12. 17	5. 2
Year	53. 4	103	−16	37. 54	[4] 23. 74	[5] 51. 59	24. 2

[1] Average temperature based on a 19-year record, 1935–53; highest and lowest temperatures from a 20-year record, 1911–30.

[2] Average precipitation based on a 19-year record, 1935-53; wettest and driest years based on a 42-year record, 1912–53; snowfall on a 20-year record, 1911–30.

[3] Trace.

[4] In 1950.

[5] In 1937.

The average date of the last killing frost in spring is April 18, and of the first in fall, October 24. The latest recorded killing frost in spring occurred on May 25, and the earliest in the fall on October 6. The frost-free period averages 189 days. Crop damage by frost is rare. Occasionally fruit crops are affected by a late spring frost, or corn or soybeans by an unusually early fall frost. Winter crops may be damaged by heaving, especially where the soil is fine textured or is imperfectly or poorly drained.

The grazing season usually lasts from late April to mid-November. Beef cattle generally stay in pasture through all but the most severe winter weather, but dairy cows are pastured for only short periods during the winter.

Rainfall is fairly evenly distributed through the growing season, but is heaviest in spring and summer and lightest in fall. Most of the creek bottoms are flooded at least once during spring and summer. Late spring and summer rains often come as downpours, and much of the water runs off before it can be absorbed. Fall, winter, and early spring rains are likely to be slow and steady. A little snow and sleet fall during the winter, but snow seldom stays on the ground more than a few weeks.

Occasionally a dry period in late summer or early fall will reduce crop yields, especially on shallow or coarse-textured soils. Prolonged wet weather during the growing seasons may harm crops on the inadequately drained soils. The poorly drained soils also are slow to warm up in the spring, and as a result, cultivation and seeding may be delayed so long that a corn crop will not mature before frost. As a rule, however, the climate is favorable for the crops commonly grown in the county.

Clark County is not subject to high winds. The average wind velocity is between 8 and 10 miles an hour. Prevailing winds are from the southwest. Hailstorms and tornadoes are rare and, when they do occur, are localized.

WATER SUPPLY

All parts of Clark County have ample water for livestock and for domestic uses (*2*). Some rural households obtain water from streams, but in most places the sources are the water-bearing layers of the glacial drift, principally sand and gravel deposits in the moraines, outwash valleys, and buried valleys. Glacial till, where it is deep enough, also furnishes some water. Wells in the glacial till are usually drilled, except where the till mantle is rather thin.

All over the county, the glacial drift is underlain by water-bearing sedimentary bedrock. Water can be obtained from this rock if the glacial deposits are too thin or too dense to supply ground water for local needs. The water from the bedrock, however, has a high content of calcium and magnesium salts, in some places so much that it is unsuitable for consumption.

VEGETATION

All of Clark County is within the deciduous forest region of the East Central States. Most of the area was originally covered by a dense hardwood forest, but there were significant acreages of prairie, and many small marshes and bogs. Except for small amounts sold, or used for fuel or building material, most of the timber cut by the pioneer settlers was burned. Later, the sale of lumber became an important source of farm income. During this period the forests were almost completely leveled. All that now remains of the extensive timber tracts are small scattered woodlots, presumably never cleared and generally on soils unsuitable for crops.

The trees, shrubs, grasses, and other plants most common in the county are identified by common and scientific name in the following list.

TREES

Scientific name	*Common name*
Acer rubrum	Red maple.
A. negundo	Boxelder.
A. saccharum	Sugar maple.
Aesculus glabra	Ohio buckeye.
Carpinus caroliniana	Bluebeech or American hornbeam.[1]
Carya ovata	Shagbark hickory.
C. cordiformis	Bitternut hickory.
C. glabra	Pignut hickory.
C. laciniosa	Shellbark hickory.
C. tomentosa	Mockernut or white hickory.
Celtis occidentalis	Hackberry.
Cornus florida	Dogwood.
Crataegus spp	Hawthorn.
Fagus grandifolia	Beech.
Fraxinus americana	White ash.
Gleditsia triancanthos	Honeylocust.
Juglans nigra	Black walnut.
Liriodendron tulipifera	Yellow-poplar or tuliptree.[1]
Morus rubra	Red mulberry.
Ostrya virginiana	Ironwood or American hophornbeam.
Platanus occidentalis	Sycamore or planetree.[1]
Populus heterophylla	Cottonwood or swamp poplar.[1]
P. tremuloides	Aspen.
Prunus serotina	Wild cherry or black cherry.[1]
P. americana	Wild plum.
Quercus alba	White oak.
Q. bicolor	Swamp white oak.
Q. coccinea	Scarlet oak.
Q. imbricaria	Shingle oak.
Q. macrocarpa	Bur oak.
Q. marilandica	Blackjack oak.
Q. palustris	Pin oak.
Q. rubra	Red oak.
Q. stellata	Post oak.
Q. velutina	Black oak.
salix nigra	Black willow.
Tilia americana	Linden.
Ulmus americana	American elm.
U. fulva	Slippery elm.

SHRUBS, GRASSES AND OTHER PLANTS

Andropogon scoparius	Prairie beardgrass.
Asclepias sullivanti	Sullivant milkweed.
Calamagrostis canadensis	Bluejoint reed bentgrass or bluejoint reedgrass.[1]
Cephalanthus occidentalis	Buttonbush.
Corylus americana	Hazel or filbert.[1]
Hibiscus palustris	Swamp rose.
Phragmites cummunis	Tall reedgrass.
Rubus spp	Blackberry.
Silphium terebinthinaceum	Prairie dock or rosenweed.[1]
Spartina pectinata	Sloughgrass or prairie cordgrass.[1]
Tripsacum dactyloides	Gamagrass.

[1] Standardized common name (*s*).

The native vegetation of the county has been classified in four major associations (*1*).

Beech-maple association.—This association of vegetation occurred only west of the Mad River valley. It was principally on the imperfectly drained Crosby soils, which are particularly extensive in this area, and possibly on the Homer soils also. The relief in this area is generally nearly level to gently undulating, and natural drainage is imperfect. The dominant trees were beech and sugar maple; also represented were white ash, white oak, shagbark hickory, wild cherry, linden, dogwood, ironwood, black oak, American elm, slippery elm, bitternut hickory, shellbark hickory, and yellow-poplar.

Subtypes of the beech-maple association were the maple-beech, situated on higher better-drained soils, principally the Celina, Randolph, Bronson, and Miami; and the wet-beech, which occupied small poorly drained areas of Crosby soils.

Oak-hickory association.—This association was confined principally to the area east of Mad River valley, although local areas of somewhat similar associations occurred to the west. The dominant trees were white oak, black oak, and shagbark hickory. Other important trees were wild cherry, dogwood, ironwood, black walnut, bitternut hickory, white ash, and scarlet oak. The soils that supported this association were mainly the smoother phases of the Miami, Kendallville, Bellefontaine, Milton, Fox, and Wawaka. These soils are predominantly undulating to rolling and have good drainage, well-developed profiles, and physical characteristics fairly favorable for plant growth. The steeper phases of these soils supported post oak, shingle oak, pignut, hickory, and mockernut hickory, besides the dominant trees of the asosciation. The Celina, Randolph, and Bronson soils in this area had chiefly bur oak, shingle oak, red oak, pin oak, and shellbark hickory.

Swamp-forest association.—This association consists of the lowland type of forest that occurred on the flood plains of streams, imperfectly drained upland flats, very poorly drained upland depressions, and in marshes and bogs. In many places, it succeeded the grass vegetation of the wet prairies and bogs. The characteristic tree growth near the streams was the black willow-cottonwood-sycamore association. On the Genesee and other deep, well-drained alluvial soils, the vegetation association was composed of elm, red maple, boxelder, hackberry, Ohio buckeye, honeylocust, and black walnut. Very poorly drained, dark-colored soils (Brookston, Millsdale, Westland, Mahalasville, and Sloan) of the uplands, terraces, and bottom lands supported an association dominated by elm, white ash, and soft maple and that also included some red oak, linden, swamp white oak, bur oak, and shellbark hickory. Of less importance in the swamp forest were boxelder, bluebeech, hackberry, pin oak, red mulberry, hawthorn, and aspen.

The Crosby and Homer soils east of the Mad River supported an elm-white ash association, in which shagbark hickory, pin oak, red oak, swamp white oak, and bur oak were also represented.

Prairies.—The prairie areas in the county were small and scattered, but practically all were within the oak-hickory association (*1*). The

wet prairies were actually more like savannas than true prairies. They occurred in several kinds of locations: On very poorly drained level or depressed uplands, around drainageways or headwaters of small streams (Kokomo soil); very poorly drained level areas on terraces (Abington and Needham soils); and sites of former bogs and marshes (Carlisle and Warners soils).

These savanna areas were wet in the early part of the year but were subject to summer droughts. The dominant vegetation was composed of tall reedgrass, sloughgrass, bluejoint reed bentgrass, prairie dock, and Sullivant's milkweed; there were also scattered trees and groves, mostly of bur oak and elm. Presumably, the wet prairie vegetation was succeeded by a swamp forest.

The dry prairies occurred on excessively drained gravelly morainic ridges (Rodman soils and steep phases of Bellefontaine soils) and in fringes on high ground surrounding the wet prairie (Warsaw soils). In the dry prairie, gamagrass and little bluestem developed. On the moraines and gravel terraces were open groves of white oak, post oak, and blackjack oak, known as oak openings. Scrubby growths of blackberry, hazel, wild plum, and herbaceous vegetation covered much of the dry prairie.

The small glacial lakes and ponds have been wholly filled by silt and plant remains, so they now contain organic soils. The original distribution of vegetation in these bogs ranged from the submerged aquatics, through the floating aquatics, the aeroaquatics, the bog or swamp shrubs and grasses, to the willows, dogwood, swamp rose, and buttonbush of the swamp forest.

AGRICULTURE IN CLARK COUNTY

AGRICULTURAL HISTORY

The Shawnee Indians who roamed this area before the white settlers came were warlike hunters, but apparently they practiced a crude form of agriculture. They grew maize, beans, pumpkins, squash, peas, cucumbers, melons, and possibly potatoes. When Gen. George Rogers Clark and his Kentucky troops came to Clark County in 1780 to punish the Shawnee Indians for raiding several Kentucky settlements, they found extensive cornfields on the Mad River bottom lands, and they burned nearly 800 acres of ripe corn. The Indians cultivated small fields, mostly on the flood plains and terraces of the Mad River. They raised no domestic livestock, but deer, bear, buffalo, grouse, quail, turkey, and fish were apparently abundant.

Permanent settlement in the area began about 1795. The fertile bottom lands and terraces were settled, cleared, and farmed before the upland areas. By 1810, about 500 acres of land was under cultivation.

To the early settlers, food and shelter were the primary considerations. The forest that covered most of the county furnished building material and fuel. Wild game and fruits furnished some of the food. An acre of land could be bought for 2 dollars, but trees had to be felled, the stumps uprooted, and the sod removed before cultivation could be started. After the land was cleared, subsistence crops such

as corn, wheat, oats, potatoes, and vegetables were planted for food and for feed for livestock. English grasses were soon introduced, but timothy and red clover were not grown until much later. Some wheat was grown as a cash crop and shipped to New Orleans. Some cash income was probably obtained from the sale of lumber and other forest products.

In the early days, when there were no nearby market towns and transportation facilities were poor, farms were, of necessity, self-sustaining. Eventually, gristmills and sawmills were established along the main streams, and villages and towns grew up around these business facilities. Prices of farm products were very low, and animal skins and whiskey were common mediums of exchange.

Between 1810 and 1850, settlement of the area continued, the forest was almost entirely leveled, and farms were expanded. Markets developed, and transportation facilities were constructed. In 1830 the Miami and Erie Canal, in the Miami Valley to the west of Clark County, was completed. It provided access to many markets and encouraged the production of corn and hogs. The National Road, the first national highway constructed by the Federal Government, was completed to the Ohio-Indiana line in 1840. The Little Miami Railroad between Cincinnati and Springfield was opened in 1846.

In the 1850's, Ohio was the Nation's leading farm State, and Clark County was the most populous agricultural county in the west-central part of the country. At that time, the corn-hog type of farming was prevalent in the county. Dairying also was fairly common, especially among Scotch-Irish and Pennsylvania Dutch families. Beef cattle production started in 1822 when a herd of Shorthorns was introduced. Between 1850 and 1900, Springfield became a manufacturing center for agricultural machinery. This encouraged a shift to mechanized agricultural methods that resulted in increased farm yields.

Early agricultural practices were in general wasteful of soil resources. Little attention was given to systematic crop rotations, growth of cover crops, prevention of runoff and soil erosion, and the return of organic matter to the soil. Practically no lime and only small amounts of fertilizer were used. Although agricultural practices have improved, there has been little change in the types of crops grown, or in their relative importance.

At the time of the survey, the agriculture of Clark County was centered around the raising of livestock for sale (mainly hogs), dairying, and the growing of corn and hay for feed and wheat for cash. The rapid growth of the city of Springfield has created a home market for dairy products, poultry and poultry products, vegetables, and some other agricultural products.

LAND USE

In 1950, 86.8 percent of the county area, or 223,237 acres, was in farms. There were 1,853 farms, averaging 120.5 acres in size. Approximately 56 percent of the farms were of less than 100 acres, and about 37 percent of the total number of farms were of less than 50 acres. Most of the small farms are near towns and trading centers. In 1950 distribution of farms by size was as follows:

Size in acres:	Number of farms	Size in acres—Continued	Number of farms
Less than 10	276	140 to 219	301
10 to 29	293	More than 219	282
30 to 49	130		
50 to 99	345	Total	1,853
100 to 139	226		

In 1949 land in farms was distributed according to use as follows:

	Acres		Acres
Cropland harvested	132,668	Woodland not pastured	4,246
Cropland used only for pasture	26,300	Other pasture (not cropland and not woodland)	31,657
Cropland not harvested and not pastured	5,066	Other land	11,099
Woodland pastured	12,201	Total land in farms	223,237

FARM TENURE

In 1950, full owners operated 64 percent of the farms in Clark County; part owners operated 12 percent; tenants, 22 percent; and managers, 2 percent. Ownership has increased and tenancy decreased in recent years. Of the 407 farms operated by tenants in 1950, 240 were operated by share tenants, 69 by tenants paying cash rent, 49 by share-cash tenants, and 49 by tenants whose rental arrangements were unspecified. Share tenancy is on a half-and-half basis in most cases.

TYPES OF FARMS

Most of the farm income in the county is from the sale of livestock, mainly hogs. Some wheat and soybeans are sold for cash, but most of the corn and oats are fed to livestock on the farm. Dairy products, horticultural specialties, poultry and eggs, and wool are the other fairly important sources of farm income.

Based on the major source of income, the 1,853 farms in the county were classified in 1950 as follows:

Type of farm:	Number	Type of farm—Continued	Number
Livestock	632	Poultry	49
Dairy	226	Vegetable	15
Field crop	180	Fruit and nut	5
General (primarily crop and livestock)	172	Miscellaneous and unclassified	574

Vegetable farms, principally those producing potatoes, are concentrated near New Carlisle on the Fox soils. Most of the livestock farms are in areas where the dark-colored soils are most abundant. Dairy farms are most extensive in the rolling areas of light-colored soils in Pleasant and Moorefield Townships.

LIVESTOCK AND LIVESTOCK PRODUCTS

In the order of their importance, the principal livestock and livestock products of Clark County are hogs, dairy cows, beef cattle, poultry and poultry products, and sheep and wool.

Hogs.—Hog-raising has been the principal source of agricultural income in the county for many years. The principal breeds of hogs are Duroc-Jersey, Hampshire, Poland China, and Chester White, in

that order. Yearly variations in the number of hogs raised depend largely on the corn-hog price ratio. In some years, it may be more profitable to sell the corn as grain.

Hogs are raised mainly in Madison and southern Harmony Townships, where the dark-colored upland soils are suitable for growing corn. Some soybean meal and tankage are purchased to supplement the home-grown corn. Marketing is done through the livestock auction yards in Springfield, South Charleston, or Dayton.

Dairy cattle and dairy products.—Dairying is second to hog-raising as a source of farm income. Dairy farms are most common on the rolling phases of the Bellefontaine, Kendallville, and Miami soils in Moorefield, German, and Pleasant Townships. Jerseys, Holstein-Friesians, and Guernseys are the most popular breeds of dairy cows. There are a few herds of Ayrshires and Brown Swiss.

Milk is marketed through a milk producers' association. Whole milk and cream are picked up and delivered by truck daily to the various markets. Most of the milk produced in the county is bought by a milk processing plant in Springfield. A condensing plant at Marysville (in Union County) uses most of that produced in Pleasant Township. Dairy farmers in the county purchase substantial amounts of concentrated feed for dairy cattle, including cottonseed meal, soybean meal, and dairy-concentrated mill feed.

Beef cattle.—The raising of beef cattle is less important than dairying in Clark County. The past practice has been to buy feeders to be finished for market. Now the trend is toward local breeding and raising of beef cattle. Aberdeen-Angus, Hereford, and Shorthorn, in that order, are the principal breeds. Ordinarily, good fat cattle are sold at private sales, and the lower grades are sold through the livestock auction yards at Springfield, South Charleston, and Dayton (in Montgomery County). Most of the feed is grown on the farm, but some commercial concentrates, mainly soybean and cottonseed meal, are purchased as supplementary feed.

Poultry and poultry products.—Poultry is important on many of the small farms of the county, particularly near Springfield, New Carlisle, and other towns. In 1950, 83,169 chickens were raised in the county. White Leghorns, White Rocks, Barred Rocks, and Rhode Island Reds are the most common breeds. Some poultrymen near New Carlisle market eggs through a cooperative arrangement, but elsewhere in the county marketing eggs is an individual enterprise. Eggs and chickens are generally sold at towns and trading centers for shipment to larger markets. Some commercial mill feed, principally chicken mash, is purchased to supplement the home-produced grain feed.

Turkeys, mostly White Holland, and a few ducks, geese, and guineas are also raised in the county.

Sheep.—Sheep raising is concentrated chiefly in Pleasant Township and around South Charleston, where permanent pastures are extensive. In 1949, a total of 15,511 sheep and lambs was sold from Clark County farms. Most of the sheep are raised locally. The Shropshire and Hampshire breeds predominate. Some western lambs are purchased to be fattened during the winter and shorn and sold in the

spring. Lambs are marketed at the auction yards in Springfield or South Charleston. Wool is sold through a wool producers' pool at Columbus. Practically all feed for sheep is produced on the farms.

Work stock.—Horses, mostly grade Percherons and Belgians, are the principal work stock. Their number has declined as mechanization of farming has progressed. In 1950 there were 1,026 horses and 49 mules in the county, as compared to 4,419 horses and 291 mules in 1940. Most of the horses are in Pike and German Townships. Feed for work stock is raised on the farm.

CROPS

Corn, wheat, and oats, in that order, have been the principal crops in Clark County. Flax and buckwheat, once minor crops, are no longer grown in significant quantities. A few new crops, including soybeans, alfalfa, and sweetclover, have been introduced since about 1919. Table 2 gives the acreage of principal crops and number of bearing fruit trees and grapevines in the county in stated years.

TABLE 2.—*Acreages of the principal crops and number of bearing fruit trees and grapevines in Clark County, Ohio, in stated years*

Crop	1919	1929	1939	1949
	Acres	*Acres*	*Acres*	*Acres*
Corn for all purposes	84, 858	55, 147	48, 821	53, 815
Harvested for grain	58, 050	45, 333	44, 688	49, 581
Cut for silage	2, 886	2, 901	1, 887	2, 449
Used for forage	23, 922	6, 913	2, 246	1, 785
Small grains threshed:				
Wheat	36, 518	24, 482	27, 530	33, 168
Oats	11, 422	19, 554	4, 128	9, 929
Barley	249	1, 197	1, 294	406
Rye	5, 059	1, 706	966	228
Soybeans harvested for beans	(1)	(1)	4, 548	7, 761
All hay	21, 185	22, 136	23, 776	23, 446
Timothy and clover, alone or mixed	18, 809	15, 746	10, 177	13, 730
Alfalfa	2, 075	4, 135	9, 001	8, 577
Other cultivated grasses	51	121	494	584
Annual legumes	100	1, 457	3, 474	170
Small grains cut green	150	677	630	385
Irish potatoes	1, 254	1, 015	880	1, 066
Vegetables harvested for sale	419	508	591	137
Berries and other small fruits harvested for sale	116	50	100	14
	Number [2]	*Number* [2]	*Number* [2]	*Number* [2]
Apple trees	37, 513	18, 125	12, 601	7, 827
Peach trees	11, 715	9, 560	3, 993	5, 069
Pear trees	5, 624	3, 241	2, 754	800
Plum and prune trees	3, 544	1, 374	785	390
Cherry trees	13, 167	2, 078	1, 022	292
Grapevines	4, 263	2, 561	4, 454	787

[1] Not reported.

[2] Number in the census year, which is 1 year later than the crop year shown at head of column.

Corn.—This has always been the most important crop. In 1950 it occupied nearly 25 percent of the land in farms and about 40 percent of the cropland harvested. The increase in yield is attributable principally to the introduction of hybrid varieties of corn, but improved management practices have also contributed.

Corn is grown in all parts of the county, on many different kinds of soils, but the best yields are obtained on dark-colored, poorly drained soils that have been artificially drained. Most of the corn is used to feed livestock on the farm where it is grown. Only a few acres of corn is cut green for silage, and very little of the crop is ground for human consumption. Corn is sold as a cash crop from a few of the corn-hog farms in the vicinity of South Charleston and on the bottom lands of the Mad River.

Corn is normally planted during the latter part of May and harvested late in October or in November. Two-row planters are commonly used for planting, and row-crop tractors for cultivating. Most of the crop is harvested with cornpickers; a little is cut with corn binders and shocked in the field. A few fields are planted on the contour, but the rectangular field pattern is more common.

Wheat.—Winter wheat has long been the most important small-grain crop. It is grown throughout the county on many different soils of the uplands and terraces. Very little is grown on the first-bottom soils because of the danger of floods and the tendency of small grains to lodge on such fertile soils. The nearly level, least eroded phases of the Fox, Bellefontaine, Kendallville, Miami, Milton, and Wawaka soils are considered the best wheat soils in the county. Average yields have increased from 12 bushels an acre in 1890 to 23 bushels an acre in 1950. Most of the wheat is sold as a cash crop.

Wheat is normally planted between September 28 and October 15, unless the corn is late in maturing or weather is unfavorable. It is harvested around the first week in July, most of it by combines but some by binders.

Hay and forage.—Hay is very important in the agricultural economy of the county. The principal hay crop is mixed red clover and timothy. Timothy and clover are grown separately to some extent. In 1949, a total of 13,730 acres of clover and timothy, mixed or alone, produced 17,539 tons of hay, an average of about 1.3 tons an acre. Alfalfa, alsike clover, Ladino clover, smooth bromegrass, and orchardgrass are sometimes seeded as part of the hay mixture.

Alfalfa has become an important crop since 1910. The average yield is about 2 tons an acre. Alfalfa is grown most extensively in areas where the soils are in good physical condition and are maintained in a high state of productivity by good management. Good internal drainage is particularly important. An alfalfa crop usually remains on the land for 2 years or more.

In some years, a considerable acreage of soybeans is cut for hay. Normally, the acreage of sweetclover or small grain cut for hay is very small.

Timothy and other forage grasses are seeded in fall with the winter-sown small grains, but legumes are seeded in the small grains the following spring between March 1 and April 15.

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Hay is cut with mowing machines when in full bloom; it is cured, raked into windrows, and loaded on racks with a hay loader. Most of it is stored in barn haymows, but some is baled or stacked in fields. Pickup balers are increasing in number, and some mow dryers are in use.

Other small grains.—Oats are not well adapted to the climate and are grown only to a limited extent. However, after a year in which the corn matures so late that winter wheat cannot be planted, some farmers may have to use spring oats as the small grain in the rotation. Oats are usually planted in the middle of March or early in April and are harvested about the middle of July. The climate is too severe for winter oats.

Rye, as a grain crop, has decreased in importance since 1919 and at present occupies only a small acreage. Barley has never been an important crop, but the acreage increased substantially between 1929 and 1939, probably because the wheat acreage was limited by Federal allotments. Since that time, the barley acreage has declined again.

Soybeans.—This crop, first grown in the county between 1920 and 1930, now occupies substantial acreages. Soybeans are grown mostly on the dark-colored soils. Most of the crop is harvested for beans and sold as a cash crop. In 1949, the average yield was about 25 bushels of beans an acre.

Soybeans are planted in May and harvested in the fall. Early maturing varieties are most commonly used, so that they can be harvested before it is time to plant winter wheat. They may be planted in rows or drilled. If they are planted in rows, they are cultivated with corn cultivators. If soybeans are planted after corn in the rotation, fertilizer ordinarily is not used.

Potatoes.—Potato-growing on a commercial scale is centered about New Carlisle. In 1949, the average yield was about 284 bushels an acre. Commercial growers ordinarily fertilize heavily at planting time and sow rye as a cover crop and green-manure crop after the harvest. The light-colored Fox soils are preferred for potatoes, which are liable to rot in dark-colored soils. About one-quarter of the 1949 acreage was irrigated. The Irish Cobbler is the most common variety; the Katahdin and Petoskey varieties are also grown.

Rotation pasture.—These pastures are hay meadows that are used for grazing after enough hay has been harvested to feed the livestock on the farm. Nearly half of the pasture in Clark County is of this type. The vegetation consists principally of timothy, clover, and alfalfa, mixed in some places with sweetclover, Ladino clover, and bromegrass. The pastures benefit from fertilizer applied to other crops in the rotation and are generally of good quality.

Minor crops.—Garden vegetables are grown chiefly for home consumption. Most farmers have small plantings of potatoes, snap beans, string beans, wax beans, sweet corn, tomatoes, lima beans, sweetpotatoes, peas, lettuce, cabbage, carrots, onions, beets, turnips, radishes, squash, melons, peppers, cucumbers, greens, and other vegetables. Some tomatoes and sweet corn are sold to local markets or canneries.

There were several commercial apple and peach orchards in the county in 1950. Most farms have a few fruit trees producing small quantities of apples, peaches, pears, plums, and cherries for family use. The number of fruit trees has declined drastically in recent years. Grapes, raspberries, strawberries, blackberries, and other small fruits are also grown on many farms, mainly for home use.

Maple sirup and sugar have been produced locally in the past, but other forest products are of minor importance.

The growing of ornamental shrubs, plants, trees, seeds, and other horticultural specialties is a fairly important source of income in Clark County.

PERMANENT PASTURES

Permanent pastures occur most extensively on the dairy and livestock farms, particularly in the hilly areas of Pleasant Township. Ordinarily, soils that are not well suited for crops, such as the hilly and steep phases of the Bellefontaine, Kendallville, Miami, Rodman, and Fox soils, the level phase of the Crosby soil, the Carlisle soils, and the bottom lands are used for permanent pasture.

The pasture vegetation is usually Kentucky bluegrass mixed with some whiteclover, although some pastures seeded by the trash-mulch method consist of smooth bromegrass, Ladino clover, and alfalfa. Fertilization and liming of pastures are not common practices, and, generally, little attempt has been made to improve pastures. Many are overgrazed and not mowed regularly. Undesirable plants, such as bullthistle, Canada thistle, teasel, ironweed, and small tree and bush seedlings can be partly controlled by regular mowing at the correct time of the year.

The most productive pastures are on the bottom-land soils and the dark-colored upland and terrace soils. These are generally of good quality and have a higher carrying capacity during dry summer months than those on more droughty soils. Some of the woodlots are used for pasture, but the carrying capacity of such pasture is low; moreover, the practice interferes with the natural reproduction of trees.

FARM POWER AND MECHANICAL EQUIPMENT

The topography of Clark County is well adapted to the use of tractors. In the 1950 census, 2,159 tractors were reported on 1,351 farms. This is a substantial increase since 1945, when 1,606 tractors were reported on 1,272 farms. Ownership of farm motortrucks increased from 533 on 468 farms in 1945 to 826 on 679 farms in 1950.

The majority of farms are equipped with tractors that have plow, cultivator, and other attachments, disk harrows, spike or spring-toothed harrows, two-row corn planters with fertilizer attachments, grain drills, grain binders, cultipackers, mowing machines, hayrakes, manure spreaders, and wagons. Many dairy and livestock farms have, in addition, hay loaders, ensilage cutters, silo fillers, stationery or pickup balers, and farm trucks. Heavy equipment such as harvesters, threshing machines, combines, cornpickers, corn binders, and

pickup balers are in many instances owned cooperatively. When they are owned by individual farmers, they are generally used by others in the community.

SUPPLEMENTAL IRRIGATION

Supplemental irrigation is not considered economically feasible in Clark County, except for the production of a few highly specialized crops, such as potatoes, flowers, or ornamental plants. The nearly level and gently undulating phases of the Fox soils are the best adapted to irrigation of any soils in the county. The very poorly drained muck soils may need extra water at times because their upper layers tend to dry out during summer droughts. Large areas of one kind of soil are better suited to irrigation than complex associations that include small bodies of well-drained, imperfectly drained, and poorly drained soils.

The soils in the following list are those considered most likely to be benefitted by supplemental irrigation.

Fox silt loam, nearly level shallow phase.
Fox fine sandy loam, nearly level phase.
Fox loam, nearly level phase.
Fox silt loam, nearly level phase.
Fox silt loam, gently undulating shallow phase.
Fox fine sandy loam, gently undulating phase.
Fox loam, gently undulating phase.
Fox silt loam, gently undulating phase.
Bellefontaine silt loam, undulating phase.
Fox silt loam, eroded gently undulating phase.
Fox gravelly loam, eroded gently undulating phase.
Fox silt loam, severely eroded gently undulating phase.
Bellefontaine silt loam, eroded undulating phase.
Kendallville silt loam, undulating phase.
Miami silt loam, nearly level phase.
Milton silt loam, nearly level phase.
Fox silt loam, nearly level deep phase.
Miami silt loam, undulating phase.
Fox silt loam, gently undulating deep phase.
Miami silt loam, eroded undulating phase.
Milton silt loam, eroded gently sloping phase.
Kendallville silt loam, eroded undulating phase.
Carlisle muck (when drained).
Carlisle muck, shallow phase (when drained).
Carlisle silty muck, shallow phase (when drained).
Warners loam (when drained).

THE SOILS OF CLARK COUNTY

TOPOGRAPHIC RELATIONSHIPS OF SOIL SERIES

The soils of Clark County have been classified in 30 series, which can be placed in four groups according to their topographic position: (1) Soils of the uplands, (2) soils of the terraces, (3) bog or organic soils, and (4) soils of the bottom lands. This grouping will aid in identifying the soils and in showing the relation of one soil to another.

SOILS OF THE UPLANDS

Upland soils, on the higher parts of the county, constitute about 68 percent of the total area of the county. These soils have developed in place, chiefly from glacial deposits. They differ in physical characteristics and suitability for agriculture because they developed under different conditions of relief and drainage.

Upland soils developed over calcareous glacial till.—Glacial till of the till plains and moraines is the most extensive soil material in the county. Weathered till formed the parent material of the well-drained Miami, the moderately well drained Celina, the imperfectly drained Crosby, and the very poorly drained Brookston and Kokomo soils. These soils, developed from similar material but under different relief and drainage conditions, make up a grouping that is called a soil catena.

Upland soils developed over calcareous glacial till that contains or is overlain by lenses of gravel and sand.—Only one soil in the county, the well-drained Kendallville, is in this group. The material is most extensive in the moraines in the northeastern part of the county; it occurs to a lesser extent on the slopes bordering the glacial valleys.

Upland soils developed over shallow deposits of glacial drift overlying limestone (or dolomite) bedrock.—Soils of this group occur only in the western half of the county. The bedrock is usually 36 inches or less below the surface. The group includes the well-drained Milton, the imperfectly drained Randolph, and the very poorly drained Millsdale soils.

Upland soils developed over stratified calcareous gravel and sand in the glacial moraines, kames, and kame terraces. This group includes the excessively drained Rodman and the somewhat excessively drained Bellefontaine soils.

Upland soils developed over relatively shallow deposits of calcareous glacial till overlying stratified calcareous gravel and sand.—The well-drained Wawaka is the only soil in this group. It occurs principally north and south of Springfield. The porous substratum of sand and gravel is 4 to 15 feet below the surface.

SOILS OF THE TERRACES (GLACIAL OUTWASH PLAINS)

Soils of the terraces have developed from silt, sand, gravel, and clay deposited on the flood plains of glacial streams. They occupy about 23 percent of the total area of the county. These terraces are known geologically as valley trains or outwash plains, but are commonly called second bottoms, or benches. They are lower than the uplands but lie above the flood plains of present streams. Generally the terraces are nearly level to gently undulating. The Rodman soils and certain phases of the Fox soils are steeper; they occur on escarpments between the flood plains and terraces, between terraces of different elevation, or between the terraces and the uplands.

Terrace soils underlain by stratified calcareous gravel and sand outwash.—This group includes the excessively drained Rodman, the well-drained Fox and Warsaw, the very poorly drained Westland and Abington soils, and some of the moderately well drained Bronson and imperfectly drained Homer soils. Although they are underlain by gravel and sand, only the lower part of these soils appears to have been derived from these materials. The upper part presumably was derived from much finer textured materials.

Terrace soils underlain by calcareous, poorly assorted glacial outwash materials.—The well-drained Mill Creek, the very poorly drained Mahalasville and Needham soils, and some of the moderately well

drained Bronson and imperfectly drained Homer soils make up this group. The parent and underlying materials are complex and varied. As mapped, most of the Mill Creek soils are immediately underlain by poorly assorted gravel, sand, and silt (locally called dirty gravel). Other areas of Mill Creek soils, as well as all the Bronson and Homer soils in this group, are derived from stratified silt and very fine sands. The substratum consists of 12 to 30 inches of stratified silt and sand and is underlain by well-assorted calcareous gravel and sand.

The Mahalasville and Needham soils were derived from and immediately underlain by stratified silts, very fine sands, and clays, which, in places, contain lenses of sandy clay, clay, or gravelly clay. In most places, this substratum overlies stratified, calcareous gravel and sand at depths of more than 4 feet.

BOG OR ORGANIC SOILS

Bog or organic soils are represented by members of the Carlisle and Warners series. In this county they occur only in the glacial valleys, on sites that formerly were ponds or marshes. Natural drainage is very poor. The organic layers were derived principally from the remains of swamp-forest trees, sedges, and reeds. Mineral matter content is low. The organic layers of the Carlisle soils overlie calcareous clay at varying depths; those of the Warners soil overlie marl or travertine.

SOILS OF THE BOTTOM LANDS

Soils of the bottom lands occupy the flood plains—nearly level areas along streams that overflow periodically. The soil material was deposited by the streams. Its nature depends on the source in the uplands and the rate at which the floodwater was moving when the material was deposited. These are young soils that have not yet developed well-defined layers. They comprise about 7 percent of the county.

Soils of the bottom lands are usually free from stone. A few contain some gravel at depths of less than 2 feet, and a very few are gravelly throughout. They are alkaline to only slightly acid in reaction. Relief is nearly level. Surface runoff is very slow; internal drainage ranges from somewhat rapid to very slow.

In Clark County, there are seven series of bottom land soils. All were developed from recent alluvium washed from uplands and terraces of calcareous Wisconsin drift. The soils differ chiefly in rate of internal drainage, which is medium in Genesee and Ross soils, medium to slow in the Eel soil, slow in Shoals soil, and very slow in Sloan, Wabash, and Algiers soils.

SOIL TYPES AND PHASES, AND LAND TYPES

In the following pages the soil types and phases and miscellaneous land types of Clark County are described in detail, and their agricultural uses and management needs are discussed. The acreage and proportionate extent of each mapping unit are shown in table 3, and the distribution of each soil is shown on the accompanying soil map. The soils are arranged in alphabetical order by series name to facilitate reference.

TABLE 3.—*Approximate acreage and proportionate extent of the soils mapped in Clark County, Ohio*

Soil	Acres	Percent
Abington silty clay loam	8,000	3.11
Algiers silt loam	1,900	.74
Bellefontaine silt loam:		
Undulating phase	2,900	1.13
Eroded undulating phase	1,650	.64
Gently rolling phase	1,800	.69
Eroded gently rolling phase	4,100	1.59
Severely eroded gently rolling phase	3,100	1.20
Bellefontaine loam and silt loam:		
Rolling phases	650	.25
Eroded rolling phases	1,050	.41
Severely eroded rolling phases	2,000	.77
Eroded hilly phases	1,000	.38
Bronson silt loam	900	.35
Brookston silty clay loam	27,800	10.80
Brookston silt loam	3,000	1.17
Carlisle muck	1,250	.49
Shallow phase	2,200	.86
Carlisle silty muck, shallow phase	1,100	.43
Celina silt loam:		
Undulating phase	8,700	3.38
Eroded undulating phase	1,100	.43
Celina-Crosby silt loams, nearly level phases	5,600	2.18
Crosby silt loam:		
Nearly level phase	28,800	11.19
Gently undulating phase	1,600	.62
Eel silt loam	1,800	.69
Fox silt loam:		
Nearly level phase	10,800	4.20
Gently undulating phase	5,000	1.94
Eroded gently undulating phase	1,300	.51
Severely eroded gently undulating phase	120	.05
Eroded sloping phase	300	.12
Severely eroded sloping phase	140	.05
Nearly level deep phase	2,900	1.13
Gently undulating deep phase	725	.28
Nearly level shallow phase	250	.10
Gently undulating shallow phase	325	.13
Eroded sloping shallow phase	150	.06
Fox fine sandy loam:		
Nearly level phase	200	.08
Gently undulating phase	140	.05
Fox gravelly loam:		
Eroded sloping phase	275	.11
Eroded gently undulating phase	140	.05
Severely eroded sloping phase	100	.04
Eroded strongly sloping phase	350	.14
Moderately steep phase	275	.11
Fox loam:		
Gently undulating phase	475	.18
Nearly level phase	225	.09
Genesee silt loam	2,800	1.09
Genesee loam	575	.22
Gravel pits	300	.12
Homer silt loam	2,100	.82
Kendallville silt loam:		
Undulating phase	2,400	.93
Eroded undulating phase	2,500	.97
Gently rolling phase	900	.35

TABLE 3.—*Approximate acreage and proportionate extent of the soils mapped in Clark County, Ohio*—Continued

Soil	Acres	Percent
Kendallville silt loam—Continued		
Eroded gently rolling phase	3, 300	1. 28
Severely eroded gently rolling phase	3, 300	1. 28
Kokomo silty clay loam	3, 900	1. 51
Made land	250	. 10
Mahalasville silty clay loam	2, 700	1. 05
Miami silt loam:		
Undulating phase	27, 000	10. 50
Nearly level phase	1, 300	. 51
Eroded undulating phase	14, 300	5. 56
Gently rolling phase	1, 300	. 51
Eroded gently rolling phase	5, 200	2. 02
Severely eroded gently rolling phase	2, 700	1. 05
Eroded rolling phase	2, 500	. 97
Severely eroded rolling phase	1, 300	. 51
Hilly phase	625	. 24
Eroded hilly phase	1, 350	. 52
Mill Creek silt loam:		
Nearly level phase	2, 600	1. 01
Gently undulating phase	675	. 26
Millsdale silty clay loam	950	. 37
Milton silt loam:		
Gently sloping phase	2, 400	. 93
Nearly level phase	500	. 19
Eroded gently sloping phase	575	. 22
Eroded sloping phase	225	. 09
Severely eroded sloping phase	190	. 07
Eroded strongly sloping shallow phase	425	. 17
Gently sloping shallow phase	170	. 06
Eroded sloping shallow phase	250	. 10
Needham silty clay loam	1, 700	. 66
Quarries	80	. 03
Randolph silt loam	400	. 16
Rodman gravelly loam:		
Eroded steep phase	1, 200	. 47
Eroded sloping and strongly sloping phases	425	. 17
Ross silty clay loam	1, 000	. 38
Ross silt loam	525	. 20
Shoals silt loam	400	. 16
Sloan silty clay loam	2, 600	1. 01
Sloan silt loam	2, 300	. 89
Steep land-limestone outcrop	325	. 13
Wabash silty clay loam	4, 400	1. 71
Wabash silt loam	325	. 13
Warners loam	150	. 06
Warsaw silt loam:		
Nearly level phase	1, 550	. 60
Gently undulating phase	160	. 06
Wawaka silt loam	1, 900	. 74
Westland silty clay loam	8, 700	3. 38
Westland silt loam	1, 300	. 51
Lakes and ponds	75	. 03
Springfield (City) sedimentation basins	40	. 02
Total	257, 305	100. 00

Abington silty clay loam (0 to 2 percent slopes) (Aa).—This is a very dark-colored, very poorly drained, deep soil developed on calcareous, stratified gravel and sand in the glacial valleys. Because it occupies large nearly level to depressed areas, it has very slow surface runoff. Its internal drainage also is very slow. Most of the areas are drained artificially by various combinations of tiling and ditching. The low-lying position and level relief of the soil keep it from eroding. It occurs largely in the Westland-Abington soil association (pl. 2) and is associated closely with the Westland, Wabash, Sloan, Fox, and Carlisle soils.

Profile description (cultivated area):

0 to 7 inches, black, firm to friable silty clay loam; coarse granular structure; relatively high in organic matter; neutral.
7 to 13 inches, black, slightly streaked with brown, silty clay loam; firm when moist, plastic when wet, and hard when dry; breaks into irregularly sized blocky aggregates; organic content high; neutral.
13 to 22 inches, very dark-gray silty clay streaked with strong brown (mostly along old root channels); firm when moist and plastic when wet; breaks to columns which can be broken down with light pressure to coarse irregularly shaped angular blocks; organic content lower than in above horizons; neutral to mildly alkaline.
22 to 36 inches, predominantly gray, mottled with yellowish brown, sandy clay to silty clay; very firm when moist and plastic when wet; breaks into coarse to very coarse blocky aggregates; contains a number of small pebbles; mildly alkaline.
36 to 54 inches, predominantly light-gray or light brownish-gray, mottled with yellowish-brown, gravelly sandy clay loam; plastic and sticky when wet and firm when moist; very coarse weak blocky structure; contains considerably more pebbles and sand grains than layer above; mildly alkaline.
54 inches +, gray and light yellowish-brown, loose, stratified, calcareous gravel and sand.

Variations occur in the texture and thickness of the soil layers and in depth to gravel and sand. Small areas with silt loam surface soils occur in places. These are either at the base of adjoining eroded slopes or adjacent to ditches or drainageways that frequently traverse and flood the soil areas. In these localities, the original black surface soil has been covered periodically with light-colored, silty soil material of varying degrees of thickness. The material has become mixed with the original surface soil during cultivation. As a result, the surface layer is now a very dark-gray heavy silt loam.

In scattered places, mainly in the upper part of the valley of the Mad River, there are small areas that have gravel and sand less than 24 inches from the surface and more than the normal amount of gravel both on the surface and throughout the soil. Northeast of New Carlisle, the soil is underlain by a layer 1 to 2 feet in thickness of stratified gravel and sand, which, in turn, overlies glacial till. In many small shallow depressions, especially in the valley of Buck Creek, the soil exhibits an abnormal silty muck surface layer 1 to 4 inches thick and a subsoil in which gray colors are more pronounced than normal.

Some small and widely distributed areas have more undulating relief. These are usually at the base of adjoining slopes.

Use suitability and management.—Practically all this soil was cleared at the time of the survey. Probably 85 percent was used for crops and the rest for pasture.

The dark-colored surface layers are relatively rich in organic matter; the deeper layers contain less. Down to 18 to 28 inches, the soil generally is moderately permeable to plant roots, moisture, and air. Below 28 inches it is dense, saturated with water during wet periods, and much less permeable. It is heavy and difficult to work, especially when wet; thus, if a good seedbed is wanted, care must be exercised to plow and cultivate it when it is at the proper moisture content. Regular incorporation of organic materials is important in maintaining favorable tilth, as the decomposition of raw humus in place has a beneficial effect in maintaining and promoting good soil structure.

The soil normally is neutral in reaction and moderately well supplied with plant nutrients, particularly nitrogen. Its water-holding capacity is high.

Where cropped, the soil is managed much as the Brookston and Kokomo and the closely associated Westland soils. Its good content of organic matter and nitrogen, high water-supplying capacity, smooth relief, favorable reaction, and good accessibility to farm machinery make this a valuable and productive soil for corn, soybeans, and adapted grasses and legumes, provided it is adequately drained and managed. At the time of the survey, however, some tiling was too widely spaced or not in good enough working order to provide optimum drainage.

Small grains generally are not so well adapted as they are on the light-colored soils, because they tend to lodge. Alfalfa and winter small grains are often injured by heaving and winterkilling. Permanent pastures on the soil, although they tend to be weedy, are highly productive in comparison to those on the lighter colored soils. For further discussion of use and management, see management group 4.

Algiers silt loam (0 to 2 percent slopes) (Ab).—This soil consists of light-colored alluvium deposited over older dark-colored alluvium. It occupies nearly level areas on first bottoms or colluvial depressions. It is associated with the Wabash, Sloan, Genesee, and other first-bottom soils and occasionally with the Westland and Abington soils of the terraces.

In general, internal drainage is slow, although the light-colored layers exhibit little or no morphological evidence of restricted drainage and consequently may be considered as having medium internal drainage. The dark-colored layers, on the other hand, give indication of having very slow internal drainage. Surface runoff also is very slow.

This soil occurs as small- to moderate-sized areas along practically all the streams of the county but it is most common in the valley of the Mad River.

Profile description (forested area):

0 to 14 inches, grayish-brown very friable silt loam; granular structure; calcareous.

14 to 16 inches, dark grayish-brown friable silt loam; granular structure; calcareous.

16 to 23 inches, black or very dark-brown friable silt loam; strongly developed fine blocky structure; contains many worm casts of silty material; relatively high in organic matter; mildly alkaline.

23 to 34 inches, black to very dark-gray silty clay loam; firm when moist and slightly plastic and sticky when wet; breaks into weakly developed

coarse columns with some medium to coarse nuciform aggregates; contains occasional worm casts; relatively high in organic matter; calcareous.
34 inches +, very dark-gray, mottled with yellowish brown, light silty clay; very firm when moist and plastic when wet; breaks into moderately developed very coarse prismatic aggregates; contains quantities of broken snail shells, some small pebbles and iron-stained streaks; calcareous.

West of Springfield, just upstream from the gorge of Mad River, the surface texture in places is a fine sandy loam. Certain spots in this area may be covered by a few inches of very recently deposited, light-colored fine sand. These are indicated on the soil map by sand-spot symbols. The depth to the dark-colored layer varies considerably, or from as little as 5 to as much as 36 inches. One of the more extensive variations is made up of small areas that have more undulating relief. These occur largely along the smaller streams and drainageways.

Use suitability and management.—An estimated 80 to 90 percent of the soil was cleared at the time of the survey. Most of this was used for cultivated crops.

This soil is normally calcareous or neutral throughout. Organic-matter content is high in the dark-colored lower layers and relatively low in the upper light-colored layers. The plant nutrient content presumably is moderately high.

The soil is readily permeable to roots, air, and moisture in its light-colored zone and moderately permeable in the upper layers of the dark-colored zone. In the deeper part, however, permeability is much less favorable. The water-holding capacity is relatively high, especially in the heavier textured dark-colored zone.

Mainly because of the friable nature of the silt loam surface soil, the soil has excellent qualities of tilth under a wide range of soil moisture conditions and, except when too wet, is easly accessible to all farm machinery.

Algiers silt loam is well suited to corn, soybeans, grasses, and most clovers. Its most unfavorable feature—susceptibility to flooding—makes it less well suited to winter small grains and alfalfa. Erosion is not a problem on this soil, but at times local floodwaters have removed surface soil, cut channels, or deposited loose sands on the surface. The soil is handled much like the associated first-bottom soils. Its management problems are similar to those of the Sloan soils. For a further discussion of use and management, see management group 3.

Bellefontaine silt loam, undulating phase (2 to 5 percent slopes) (Bk).—This well-drained to somewhat excessively drained, light-colored, upland soil has developed over stratified calcareous sand and gravel deposits of the moraines, kames, and kame terraces. It is characterized chiefly by its reddish-brown or brown plastic subsoil. In profile features, the soil closely resembles the Fox soils. It differs mainly in being considerably shallower to parent material, and in the poorer assortment of its underlying gravel and sand. The undulating relief usually is not of uniform gradient, rather it is knobby or hummocky. The irregular slopes are typical of the knob-and-kettle morainic areas in which the soil occurs. The soil is largely in the morainic areas of the northeastern part of the county and adjacent to the valley walls of Buck Creek and Mad River, north of Springfield.

The soil's relatively high topographic position, together with its undulating relief, encourages medium surface runoff. The loose porous nature of the sand-and-gravel substratum contributes to relatively rapid internal drainage.

This soil is closely associated with the Kendallville, Rodman, and Miami soils and with other Bellefontaine soils. It occurs largely in the Bellefontaine-Rodman soil association.

Profile description (pastured area):

0 to 8 inches, grayish-brown to yellowish-brown very friable silt loam; weak medium granular structure; contains occasional small pebbles; neutral; in wooded areas the 2-inch surface layer is dark grayish-brown silt loam.

8 to 15 inches, brown friable silt loam; weakly developed coarse granular structure; slightly acid.

15 to 32 inches, dark reddish-brown clay loam; firm when moist and hard when dry; breaks into coarse subangular blocky aggregates; contains a few scattered pebbles up to ½ inch in diameter; medium to strongly acid.

32 to 38 inches, brown or reddish-brown gravelly clay loam; firm when moist, plastic and sticky when wet, and hard when dry; breaks into irregularly shaped angular pieces; material changes fairly abruptly from the above layer; tongues or lenses of this layer extend into the underlying material; slightly acid.

38 inches +, yellowish-brown, loose, stratified, calcareous gravel and sand; pebbles are as large as 3 inches in diameter.

The profile varies chiefly in the texture and thickness of the layers and in the depth to the sand-and-gravel substratum. A few areas have a loam or fine sandy loam surface soil. Where the soil is closely associated with the Kendallville and Miami soils, small areas of those soils are included with it on the soil map. In some places, the soil commonly overlies 1 or 2 feet of glacial till which, in turn, is underlain by gravel and sand. In other places, especially adjacent to the valley walls of the major glacial valleys, the underlying parent material consists of interlayered thin lenses of glacial till in gravel and sand.

A few areas of the soil have almost level relief. These occupy kettle holes or smooth depressed areas more or less surrounded by more sloping Bellefontaine soils. Here, the surface soils are thicker and darker in color than is typical.

Use suitability and management.—When the survey was made, probably not more than 85 percent of the soil was cleared and being used for cultivated crops or pasture.

This soil is not naturally well supplied with organic matter, even in virgin areas. Natural fertility is apparently moderately high, and soil reaction ranges from slightly to medium acid. The entire profile is readily permeable to plant roots and moisture and permits air to circulate freely. However, largely because of the medium to rapid underdrainage, the soil holds water only moderately well. Some high-moisture-requiring plants, such as corn, may be injured by drought during the normally dry months of August and September. Tilth is good to very good under a fairly wide range of soil moisture conditions, and the relief is favorable for the use of all farm machinery.

This Bellefontaine soil, in general, is well suited to most of the common crops and, if properly managed, is especially well suited to wheat, barley, alfalfa, and deep-rooted clovers and grasses. Although inherently moderately fertile, the soil responds well to fertilizer and lime. Productivity can be maintained and soil conserved by using a 4-year rotation containing 2 years of meadow. The meadow

crop adds organic matter, maintains fertility, improves soil structure, and increases the water-holding capacity. For a further discussion of use and management, see management group 5.

Bellefontaine silt loam, eroded undulating phase (2 to 5 percent slopes) (BF).—This phase differs from Bellefontaine silt loam, undulating phase, in chiefly being more eroded. Fifty percent or more of the original surface soil and, in places, a part of the subsoil have been removed by erosion. The present surface soil, a mixture of the former surface soil and upper subsoil to plow depth, is a brown or yellowish-brown, friable, heavy silt loam to silty clay loam. The underlying horizons are similar to the corresponding horizons of the undulating phase.

Use suitability and management.—When the survey was made, all of this soil had been cleared. Most of it was in cultivation, a smaller percentage was in permanent pasture, and a few acres were idle.

Erosion has affected this soil by decreasing its water-absorbing and supplying capacities, increasing susceptibility to further erosion, lowering fertility, adversely affecting tilth, and lowering its productivity. Because of erosion, this phase is not so well suited to cultivated crops as the undulating phase. Management practices should be directed toward improving fertility, adding organic matter, and controlling further erosion. For a further discussion of use and management, see management group 7.

Bellefontaine silt loam, gently rolling phase (5 to 10 percent slopes) (BG).—This phase is similar in profile characteristics to Bellefontaine silt loam, undulating phase, except that the various horizons are thinner, and the slopes are greater. It has a higher potential surface runoff and a lower water-absorbing capacity. It occurs on the kame terraces along the major streams, on the hummocky moraines, and on escarpments along drainageways.

Use suitability and management.—Most of this soil has been cleared, but a significant acreage was in forest at the time of the survey. Probably more than 75 percent of the cleared land was in permanent pasture.

With adequate measures for erosion control, this soil can be used for cultivated crops. Because of greater water losses by runoff, it is less productive than the undulating phase in most years. For further discussion of use and management, see management group 8.

Bellefontaine silt loam, eroded gently rolling phase (5 to 10 percent slopes) (BE).—This phase differs from Bellefontaine silt loam, undulating phase, in having stronger slopes and in being more eroded. The present surface soil, to plow depth, is a brown or yellowish-brown heavy silt loam or silty clay loam. This layer includes a part of the former subsoil. Small gullies have formed in places. Surface runoff is rapid, and internal drainage is somewhat rapid. Much of this phase has a hummocky, irregularly sloping relief. Some areas, however, occupy escarpments that have relatively uniform slopes. Included are small, scattered areas that have a loam surface soil. This phase is the most extensive of the Bellefontaine soils in the county.

Use suitability and management.—All of this soil has been cleared. Most of it was in cultivation at the time of the survey. Some, however, was in permanent pasture, and a minor acreage was idle.

The soil is fairly well suited to cultivated crops if it is adequately protected from further erosion. Erosion has affected the soil by increasing runoff, decreasing water-absorbing and water-holding capacity, impairing tilth, and lowering fertility. For a further discussion of use and management, see management group 8.

Bellefontaine silt loam, severely eroded gently rolling phase (5 to 10 percent slopes) (BH).—Erosion has removed the original surface soil and a part of the subsoil from many areas of this soil. The present surface layer is 6 to 8 inches of brown or reddish-brown heavy silt loam or silty clay loam, a large part of which consists of the former subsoil. The rest of the profile is similar to that of Bellefontaine silt loam, undulating phase.

There are a few scattered gullies. Surface runoff is rapid to very rapid, tilth is poor, and fertility is low. Small included areas have loam or gravelly loam surface soil. These are indicated on the map by gravel symbols.

Use suitability and management.—All this soil has been cleared and was under cultivation at one time. When the survey was being made, many fields were in permanent pasture, but most of the soil was still cultivated. A relatively minor acreage was idle and reverting to forest.

Largely because of its eroded condition and susceptibility to further erosion, this soil is not suited to cultivated crops. If properly managed, it is well suited to pasture. With adequate fertilization, good stands of desirable pasture grasses can be established and maintained. For a further discussion of use and management, see management group 10.

Bellefontaine loam and silt loam, rolling phases (10 to 15 percent slopes) (BC).—This separation consists of a complex of Bellefontaine silt loam, rolling phase, and Bellefontaine loam, rolling phase. It is estimated that the silt loam soil covers about 60 percent of the area mapped as this complex; and the loam soil, about 40 percent. These soils occur largely in the rolling glacial moraines. The silt loam soil is underlain by calcareous gravel and sand; the loam soil, chiefly by calcareous sands and fine gravel.

These light-colored upland soils are well drained to somewhat excessively drained. Surface runoff is rapid, and internal drainage is medium to rapid because of the porous nature of the soils and parent material. These soils are uneroded or only slightly sheet eroded. They occur in the Bellefontaine-Rodman soil association and are associated with the Kendallville, Miami, and Rodman soils, and with other Bellefontaine soils.

Except for differences in texture, the two soils have similar profiles. The silt loam soil is practically identical to Bellefontaine silt loam, undulating phase, except that its corresponding horizons are slightly thinner.

Profile description of the loam soil (cultivated area):

0 to 8 inches, yellowish-brown loam; very friable; granular structure; slightly acid.

8 to 14 inches, brown heavy loam; friable; granular structure; slightly acid.

14 to 29 inches, dark reddish-brown sandy clay loam; firm when moist and moderately plastic and sticky when wet; subangular blocky structure; medium acid.

29 to 38 inches, reddish-brown or brown fine gravelly clay loam; firm when moist and plastic and sticky when wet; coarse blocky structure; tongues of this layer commonly extend into the underlying material; slightly acid.
38 inches +, yellowish-brown, loose, stratified, calcareous coarse sand and fine gravel.

The profile varies chiefly in texture and thickness of the layers and in depth to the substratum. Small areas of Kendallville and Miami soils are included in places.

Use suitability an management.—At the time of the survey, an area ranging from approximately 40 to 50 percent of the separation was in forest. Although a significant acreage was used as cropland, most of the cleared land was used for permanent pasture.

These soils are apparently well supplied with most plant nutrients, are slightly to medium acid in reaction, and are low in organic matter and nitrogen. They have favorable tilth over a fairly wide range of moisture conditions. Plant roots easily penetrate the soils, and air and moisture circulate freely.

Although the soils are moderately deep and have relatively heavy textured subsoils that hold water moderately well, their moisture-supplying capacity is only fair because rainfall is removed rather rapidly as runoff. Use of farm machinery is difficult because of the slopes.

Pasture is considered the best use of these soils, as they are too steep and too subject to excessive runoff and erosion to be cultivated. Pastures on these soils appear to be affected less by droughts than on the associated Rodman soils. With adequate amendments and control of grazing and weed growth, excellent pastures producing good yields can be established and maintained. For a further discussion of use and management, see management group 11.

Bellefontaine loam and silt loam, eroded rolling phases (10 to 15 percent slopes) (Bʙ).—This separation contains the same soils in about the same proportion as Bellefontaine loam and silt loam, rolling phases. The soils of this separation, however, are more eroded. Moderate sheet erosion has removed 50 percent or more of the original surface soil and up to 25 percent of the subsoil. Although erosion losses have been uneven, in most places the plow layer is a yellowish-brown or brown, friable, heavy silt loam or loam.

Runoff is rapid, susceptibility to further erosion is high to very high, and water-supplying capacity is only fair. The soils occur principally in the northeastern parts of the county on hummocky tracts in the moraines and on slopes along streams and drainageways.

Small areas of these soils have gravelly silt loam or loam surface soils and contain considerable gravel throughout the soil mass. These are indicated on the map by gravel symbols.

Use suitability and management.—When the survey was made, almost all of this unit had at one time been cleared and cultivated. Most of it was still used for crops, but some was used for pasture. Crop yields are variable. They are lower on the average than those on Bellefontaine silt loam, undulating phase, but they vary greatly with the amount of rainfall during the growing season.

This unit is not well suited to crops that require intertillage because it has steep slopes, very rapid runoff, high erosion hazard, and rela-

tively poor accessibility to machinery. It is best suited to pasture under existing conditions. Pasture management is similar to that for Bellefontaine loam and silt loam, rolling phases. For a further discussion of use and management, see management group 11.

Bellefontaine loam and silt loam, severely eroded rolling phases (10 to 15 percent slopes) (BD).—These soils are similar to Bellefontaine loam and silt loam, eroded rolling phases. They differ chiefly in being more severely eroded. In most places all of the original surface soil and more than 25 percent of the subsoil have been removed by accelerated erosion. Shallow gullies are relatively common. In places the soils are more deeply and severely gullied.

Soils of this separation usually have brown or reddish-brown, friable to firm surface soil to plow depth. The deeper horizons are similar to the corresponding layers of the rolling phases of Bellefontaine loam and silt loam. These soils occur either on slopes along drainageways or on hummocky morainal slopes. The most extensive areas are in the northeastern part of the county.

Use suitability and management.—All of this separation had been cleared and cultivated, but probably 5 to 10 percent was idle at the time of the survey. The remaining cleared land was about equally divided between cropland and pasture. The crop yields were much lower than on Bellefontaine silt loam, undulating phase.

The loss of the original surface soil by erosion has resulted in a loss of plant nutrients, organic matter, and good tilth, a lowering of the water-supplying capacity, and an increase in susceptibility to further erosion. The range of moisture content under which the soils can be tilled is narrow. Water is only moderately well absorbed, and runoff is very rapid. The relatively steep slopes are unfavorable for the use of heavy farm machinery. Largely because of these features, these soils are not suited to the production of intertilled crops. However, they are moderately well suited to pasture. They are responsive to good management, and good stands of pasture grasses can be established and maintained. Where practicable, the cultivated areas should be placed in pasture. For a further discussion of use and management, see management group 11.

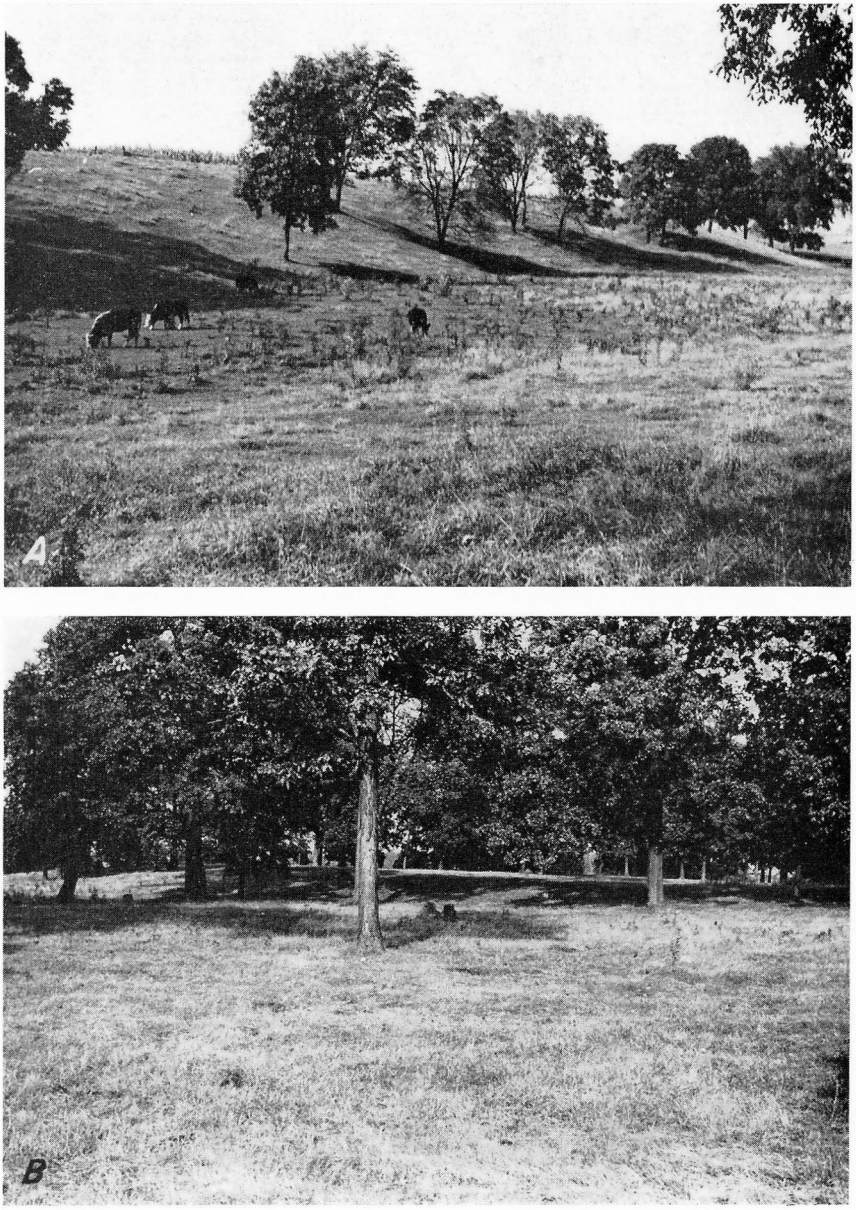
Bellefontaine loam and silt loam, eroded hilly phases (15 to 35 percent slopes) (BA).—These soils consist of an intricate association of the eroded hilly phases of Bellefontaine silt loam and Bellefontaine loam. These phases are like Bellefontaine loam and silt loam, rolling phases, except that they are on steeper slopes and are more eroded. The degree of erosion varies. About 10 percent of the separation is slightly eroded; 35 percent, moderately eroded; and 55 percent, severely sheet eroded. Some shallow gullies occur on the moderately and severely eroded areas; deep gullies are less extensive and occur in only a few places.

Much of this unit is on slopes along streams, principally along the upper parts of the Mad River and Buck Creek. Some, however, is in the irregularly sloping morainal areas. Owing to the steep slopes and generally eroded condition, the soils have very rapid runoff and a relatively low capacity to absorb and supply moisture.

Use suitability and management.—About 80 to 90 percent of the unit had been cleared and was in agricultural use at the time of the survey.

Kame in background is mapped as Bellefontaine loam and silt loam, eroded hilly phases, gravel and sand.

View of the upper Mad River Valley from the west wall



A, Carlisle muck in foreground is used for pasture.
B, Grazed woodland on Celina silt loam, undulating phase.

A, Well-prepared seedbed for corn on Crosby silt loam, nearly level phase, and Brookston silty clay loam.

B, Dark-colored Mahalasville silty clay loam (background) and light-colored Mill Creek soils (foreground) in a glacial outwash valley.

Although there was a significant acreage of cropland, most of it was used for pasture.

The soils are unsuited to tilled crops, largely because of their steep slope, eroded condition, high runoff, susceptibility to further erosion, and poor accessibility to farm machinery. They are best suited to pasture but need adequate fertilization and possibly liming before good stands of pasture grasses can be established. Once high-quality pastures are established, they are relatively easily maintained and improved. Regulated grazing, weed control, and application of fertilizers and lime will maintain the pastures. The steepness of the slopes, however, virtually prevents the use of mowing machines in suppressing weed growth and causes relatively rapid runoff. Consequently, the soils are droughty and produce little forage during the drier summer months. For a further discussion of use and management, see management group 11.

Bronson silt loam (0 to 2 percent slopes) (BL).—This soil developed from silts and sands over stratified calcareous gravel and sand. It is a deep, moderately well drained, light-colored soil of the glacial outwash valleys. It is located largely in the Fox-Homer-Warsaw soil association, where it occurs in close association with the Fox, Homer, Westland, and Abington soils. It is very similar to Fox silt loam, nearly level phase, but is slightly more poorly drained internally, is lighter colored, and is slightly mottled in the subsoil.

Slopes range from 0 to 5 percent, but most of them are less than 2 percent. Owing to the almost level to gently undulating relief, surface runoff is slow to very slow. Although the soil has a porous substratum, internal drainage is slow to medium because there are not enough natural outlets to remove the ground water.

Practically none of the soil is eroded. Where there is any erosion it is only slight. A few low-lying areas are covered with light-colored colluvial wash brought down from adjoining eroded slopes. The soil occurs in fairly small areas and is not extensive.

Profile description (cultivated area):

0 to 8 inches, dark grayish-brown very friable silt loam; fine granular structure; neutral.

8 to 17 inches, yellowish-brown friable silt loam; medium granular structure; slightly acid.

17 to 24 inches, yellowish-brown, slightly mottled with grayish brown, silty clay loam; friable to firm; breaks into medium-sized nutlike pieces; slightly acid.

24 to 36 inches, yellowish-brown clay loam mottled with grayish brown; breaks to coarse blocky pieces; firm when moist and slightly plastic and sticky when wet; darker colored and contains considerable small gravel in lower 5 inches; slightly acid.

36 to 56 inches, mottled yellowish-brown, light brownish-gray, and light-gray friable gravelly loam; massive structure; material represents weathered gravel and sand and contains considerable clay in places; neutral to alkaline.

56 inches +, grayish-brown, loose, stratified gravel and sand; calcareous.

The soil varies but little in color, texture, structure, and arrangement of its main soil layers. However, the depth to loose calcareous gravel and sand varies considerably. In many places it is only 36 inches from the surface.

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In the valley of Honey Creek east of New Carlisle, the soil has developed from thin deposits of outwash gravel and sand that overlie glacial till. Here, the loose calcareous gravel-and-sand substratum is rarely present, and the unassorted till commonly is directly under the lower subsoil. In several places south of Springfield, the soil apparently has developed from shallow deposits of till overlying gravel and sand. Scattered patches of this soil have fine sandy loam or very fine sandy loam surface textures. Also included with this soil are inextensive areas that have more silty textures through the profile. These areas, which occur in the valleys of the upper part of the Little Miami and its North Fork, are underlain by thin lacustrine deposits of silt and fine sands, which, in turn, are underlain by well-assorted gravel and sand.

Use suitability and management.—Practically all this soil was used as cropland at the time this survey was made. It is normally slightly acid, low in organic matter, and moderately well supplied with most plant nutrients. The permeability of the soil to moisture, air, and plant roots is normally moderately good. However, an occasional high water table somewhat retards permeability. Owing to its slow runoff, the soil receives considerable water, which it absorbs well. It also has a good capacity to retain and supply moisture. Tilth is excellent over a wide range of moisture conditions, and the relief favors the use of all farm machinery. Although it shows evidences of slow to medium internal drainage, the soil apparently does not need artificial drainage to produce crops satisfactorily.

This soil is well suited to all the common crops, including alfalfa, and is productive in favorable seasons if it is properly managed. It is less droughty than the associated Fox soils. Wheat, oats, grasses, and clovers do well on this soil, and corn does moderately well. Continued productivity can be maintained through adequate fertilization and liming and the use of a 3- or 4-year rotation designed to add humus and maintain favorable soil structure. Controlling erosion is not a problem. For a further discussion of use and management, see management group 2.

Brookston silty clay loam (0 to 2 percent slopes) (Bn).—This very poorly drained upland soil is the most extensive dark-colored soil in the county. It is locally called black land or black loam and is common in much of western Ohio. It has developed over calcareous glacial till and is the very poorly drained member of the soil catena that includes the Miami, Celina, Crosby, and Kokomo soils. It is closely associated with these soils, particularly the Crosby.

As the soil typically has almost level and somewhat depressed relief, surface drainage is very slow. Natural internal drainage likewise is very slow, largely because of the high water table, fine-textured subsoil, and the relatively impermeable nature of the underlying glacial till. Practically all of the soil, however, has been drained enough to permit cropping.

This soil, although widely distributed, is most extensive on the glacial till plain in the southeastern part of the county. Here, it occupies fairly large irregularly shaped areas on large flats and in basinlike depressions. It is less extensive on the till plains in the northwestern and south-central parts of the county. There, as well

as in the more rolling morainic areas, it occupies small- to medium-sized areas in slight depressions that form a dendritic pattern along the heads of small drainageways. Most of the soil is in the Crosby-Brookston-Celina soil association.

Profile description (wooded area):

0 to 6 inches, forest litter and a dense mat of grass roots overlying a very dark-gray to black silty clay loam; friable when moist and only slightly plastic when wet; granular structure; contains many grass roots; relatively abundant supply of organic matter; neutral.

6 to 15 inches, black silty clay loam; firm when moist and plastic when wet; coarse granular structure; relatively high in organic matter; neutral.

15 to 24 inches, mottled olive, dark grayish-brown, and very dark-gray clay loam; breaks into moderately developed medium-sized blocky aggregates; strongly plastic and sticky when wet and firm when moist; some organic matter; neutral.

24 to 52 inches, mottled olive-yellow and light-gray gritty clay loam; plastic when wet and firm to very firm when moist; breaks out into relatively weakly developed coarse blocky pieces; contains a few widely scattered weathered limestone and dolomite pebbles; becomes more friable and more yellow in color with increasing depth; mildly alkaline. (Water table occurs at a depth of 44 inches in this profile.)

52 inches +, mottled yellowish-brown and gray gravelly clay loam calcareous glacial till; compact but friable; composed of unassorted silt, clay, sand, and pebbles; waterlogged; moderately alkaline.

The profile varies chiefly in color, texture, and thickness of layers and in depth to calcareous glacial till. Some areas at the base of slopes are covered with shallow layers of light-colored colluvial wash, and some, along small drainageways that occasionally flood, are covered with light-colored alluvium. In many places, these overwash layers gradually mix with the original dark-colored surface soil during tillage.

Scattered small areas have more undulating relief than is typical. Some have slopes as strong as 4 or 5 percent and are along narrow, sloping drainageways or along the outer borders of large areas of Brookston soil.

In many scattered places, especially in the northwestern part of the county, the dark-colored surface layers are 8 inches or less thick. These have heavy, mottled subsoils similar to those of Crosby silt loam mapped elsewhere in western Ohio. The soil in many sections, particularly in the northwestern part of the county, has lighter colored, lighter textured, and thinner surface soils than are typical. These areas are in close association with larger areas of Crosby soils and more or less represent a gradation toward those soils.

Use suitability and management.—At the time of the survey, about 95 percent of this soil was cleared and artificially drained. Probably more than 90 percent of the cleared land was used for cultivated crops, and the rest was in pasture. The soil is one of the most desirable extensive soils for general or livestock farming, and practically all of it was being kept in good condition.

The dark-colored surface layers of this soil are normally near neutral in reaction and relatively high in organic matter and nitrogen, but they usually require phosphorus and potassium fertilizers. With adequate artificial drainage, they also are normally moderately permeable to plant roots, air, and moisture. The denser, more compact

subsoil, however, tends to hinder the downward movement of plant roots and moisture and the circulation of air. Largely because of its favorable thickness and high clay content, the soil has excellent water-holding capacity. Its water-supplying capacity is high and during wet seasons is sometimes excessive. The high water table and excessive soil moisture, however, can be controlled through adequate drainage.

It is important to work this soil only when the moisture content is right. If worked when too wet, the surface soil tends to run together and to form hard clods on drying. Any type of farm machinery can be used, provided moisture conditions are right.

Where it is drained, the soil is well suited to the common field crops, especially corn, soybeans, and mixed hay. If properly managed, it is highly productive. It is somewhat less well suited to alfalfa, but this crop does well in normal seasons if the soil is adequately drained and fertilized. Owing to its high nitrogen supply, the soil is not so well suited to small grains, which tend to produce a heavy growth of straw and to lodge. This tendency can be overcome to some extent through use of potassium and phosphorus fertilizers. Winter small grains and clovers are often injured by heaving and winterkilling on this heavy soil.

This soil is often used and managed in the same way as the closely and often intricately associated darker colored Kokomo and light-colored Crosby soils. Management requirements of this Brookston soil differ widely from those of the Crosby soils, but in many cases it is difficult to manage it separately because its areas are small. For a further discussion on use and management, see management group 4.

Brookston silt loam (0 to 2 percent slopes) (Bm).—This dark-colored, very poorly drained, upland soil is similar to Brookston silty clay loam except for its silt loam surface soil and a slightly coarser texture throughout the profile. Most of this soil occurs on the flat till plains in the northwestern and extreme south-central parts of the county. In these areas, the texture is the result of natural soil-forming processes. In smaller areas of Brookston silt loam that occur in other parts of the county, the silt loam surface texture results from silty material washed from adjoining uplands and mixed with other soils during cultivation. A few areas, mostly at the base of adjoining slopes, have 2 to 5 percent slope gradients.

Use suitability and management.—Practically all of this soil is cleared. Most of it was cultivated when the survey was made, and probably not over 15 percent was in pasture.

Brookston silt loam is well suited to cultivated crops and is productive when drained. Although it is considered slightly less fertile than Brookston silty clay loam, it has better tilth and is less likely to bake, clod, or puddle. Problems of use and management are similar for the two soils. For a further discussion of use and management, see management group 4.

Carlisle muck (0 to 2 percent slopes) (Ca).—This is a deep, very poorly drained, black organic soil of the bogs, swamps, and depressions in the glacial outwash valleys. These areas were once shallow ponds or marshes in which organic materials, derived largely from grasses, sedges, and trees, accumulated. The soil is now characterized by black muck surface layers, usually a thin subsurface layer of peat,

and a substratum of waterlogged gray clay that overlies gravel and sand at variable depths.

The soil occupies low-lying basinlike areas. Consequently, surface runoff is very slow and sometimes ponded. Internal drainage also is very slow. The soil is most concentrated in the upper Mad River and Buck Creek valleys. The soil areas range from small to large and commonly occur in association with the Abington, Westland, Warners, and other Carlisle soils on the low terraces. The soil is in the Carlisle-Warners soil association.

Profile description (pastured area):

0 to 6 inches, black, nearly loose, granular muck that is loose and chaffy in upper 2 inches; contains a few snail shells; neutral.
6 to 13 inches, black, compact, friable muck; breaks out in large chunks; contains some distinguishable plant remains; neutral to slightly acid.
13 to 30 inches, black, relatively compact but friable muck; massive structure; contains abundant partly decomposed plant remains and becomes softer, less compact, and more fibrous in lower 10 inches; medium acid.
30 to 50 inches, very dark grayish-brown fibrous macerated peat; massive structure; medium acid.
50 inches +, gray, plastic and sticky, calcareous clay.

The soil varies considerably within short distances in thickness of the black muck layer and in depth to gray clay. In many places, the peaty layer is absent and the depth to clay is 36 inches or less. Noticeable variations also occur in the degree of compactness and granulation of the muck. Areas at the foot of slopes may have thin overcoatings of light-colored mineral soil material washed down from the eroded slopes. Small raised patches on more undulating relief occur here and there, usually on seepy spots at the base of slopes.

Use suitability and management.—Practically all this soil was cleared at the time of the survey. Probably more than 90 percent of it was in permanent pasture (pl. 3, *A*). The rest was used largely for cultivated crops.

The dark mucky layers of this soil are very high in organic matter and nitrogen but relatively low in phosphorus, potash, and minor elements. The immediate surface layer is normally nearly neutral in reaction, but, from there downward, the layers are increasingly acid until calcareous clay or gravel is reached.

In the undrained state, the high water table restricts the downward growth of plant roots and the percolation of water and movement of air through the soil. Although these features can be corrected to some extent with artificial drainage, the soil is difficult to drain because of its basinlike relief and low grade to drainage outlets. Most of the areas, however, have been drained by ditches and some tiling to the extent that they will produce fair pasture. Only a few areas are drained well enough to produce crops satisfactorily every year.

The soil has excellent tilth over a wide range of moisture conditions, but, unless adequately drained, it is commonly too soft and wet, even in dry periods, to permit the use of ordinary farm machinery.

Unless adequately drained, this soil is poorly suited to cultivated crops and is better suited to permanent pasture. In many parts of the State it is very productive, under optimum drainage, of special crops such as potatoes, onions, celery, and sweet corn. In Clark County, however, it occurs in such small areas and is so difficult to drain that growing of such specialized crops may not be feasible. At the time

of the survey, pastures on this soil were of only fair quality and contained numerous weeds. For a further discussion of use and management, see management group 9.

Carlisle muck, shallow phase (0 to 2 percent slopes) (CB).—This shallow, very poorly drained, black organic soil is similar to Carlisle muck in all essential features. It differs from it chiefly in having a much thinner organic layer, shallower depth to clay or gravel, and lack of a distinct peaty subsurface layer. The black organic layer usually is more than 12 inches but less than 36 inches thick. The soil is commonly closely associated with the Abington, Westland, Wabash, Sloan, and Warners soils. It occurs as moderately large to large areas and is the most extensive organic soil in the county.

Profile description (pastured areas):

0 to 4 inches, black very friable muck; weakly developed fine granular structure; neutral.
4 to 13 inches, black, very friable and somewhat compact, silty muck; more or less massive structure; slightly acid.
13 to 18 inches, very dark grayish-brown fibrous highly decomposed peat; contains considerable light brownish-gray silty clay and a few small pebbles; medium acid.
18 inches+, light brownish-gray or gray clay and gravel; contains some decomposed plant remains; grades into stratified gravel and sand; neutral.

The soil varies from place to place in thickness of its organic layer and in the nature of the underlying material. In places, especially in the upper part of the valley of Buck Creek, it lacks the usual clay horizon and its organic layers are underlain by marly gravel. In a few areas the muck is more fibrous than typical.

Use suitability and management.—Practically all of this soil had been cleared and was being used for permanent pasture at the time of the survey. Largely because of its shallower muck layer, it is more difficult to drain and is not so well suited to cultivated crops as Carlisle muck. The pastures on the soil are similar to those on Carlisle muck and have similar management problems. For a further discussion of use and management, see management group 9.

Carlisle silty muck, shallow phase (0 to 2 percent slopes) (CC).—This very poorly drained organic soil differs from Carlisle muck chiefly in having a considerably thinner dark-colored organic layer that contains a higher proportion of silty mineral soil material. The thickness of the black layer usually is between 12 and 36 inches. For the most part, the soil represents Carlisle muck, shallow phase, onto which silty materials have washed from eroded adjacent slopes. This silty wash has been mixed gradually with the muck materials during cultivation. The Abington, Westland, Warners, and other Carlisle soils are the principal associated soils.

Profile description (pastured area):

0 to 3 inches, black very friable silt loam or silty muck; mildly alkaline.
3 to 12 inches, black friable silty muck; slightly plastic and sticky when wet; neutral.
12 to 20 inches, black, smooth, silty muck; plastic and very sticky when wet; contains more clay than horizon above; neutral.
20 to 24 inches, olive-gray silty clay; plastic and sticky when wet; contains some plant remains; mildly alkaline.
24 inches+, gray calcareous gravel and clay.

Considerable variation exists in the silt content and in depth of the black organic layer. In some places, a thin peaty layer occurs beneath the muck horizons; in others, the smooth, plastic silty clay layer may be lacking.

Use suitability and management.—Practically all this soil had been cleared and was being used as cropland or pasture at the time of the survey. It is rather poorly suited to cultivation unless adequately drained, and drainage is likely to be difficult. Because of its higher mineral content in the muck horizons, the soil probably can be made more productive than Carlisle muck, shallow phase, but it presents similar problems of use and management. For a further discussion of use and management, see management group 9.

Celina silt loam, undulating phase (2 to 5 percent slopes) (CE).—This soil is locally known as yellow clay or brown clay. It is a moderately well drained upland soil that developed over calcareous glacial till. Although it resembles Miami silt loam, undulating phase, it has more imperfect drainage and certain color differences. Its subsoil has a little more of yellow and a little less reddish brown than the Miami and is slightly mottled with grayish brown. Most of the slopes have a comparatively uniform gradient, but a few have a subdued hummocky appearance. Only a medium or low percentage of the rainfall is removed by surface runoff, and internal drainage is moderate to slow. A few areas that are largely in woods show little or no evidence of accelerated erosion (pl. 3, *B*). More than 90 percent of the soil, however, is slightly sheet eroded. Gullies, however, are uncommon, and wherever they occur they are small and shallow.

The soil occurs as small to moderately large areas scattered throughout all parts of the county. It is underlain by glacial till and is closely associated with the Miami, Crosby, Brookston, and Kendallville soils. It is most extensive on the till plains of the northwestern, southeastern, and extreme south-central parts of the county. It is in the Crosby-Brookston-Celina soil association in these areas. In other parts of the county, it is largely in the Miami-Kendallville-Celina-Crosby association.

Profile description (pastured area):

0 to 8 inches, yellowish-brown to grayish-brown very friable silt loam; weak granular structure; in the virgin condition a 2- or 3-inch dark grayish-brown very friable silt loam is on the surface; slightly acid.

8 to 12 inches, yellowish-brown, friable silty clay loam; breaks to well-developed nutlike pieces; thin grayish-brown films are on the cleavage planes of the soil aggregates; slightly acid.

12 to 20 inches, yellowish-brown, weakly mottled with light grayish-brown, heavy silty clay loam; breaks to moderate-sized nutlike pieces; firm when moist and plastic when wet; medium acid.

20 to 28 inches, dark yellowish-brown, slightly mottled with gray, heavy clay loam; breaks to comparatively large blocky pieces; firm to very firm when moist and relatively plastic and sticky when wet; contains some weathered glacial pebbles; slightly acid.

28 inches +, yellowish-brown, calcareous, compact, glacial till of clay loam texture.

As mapped, areas of this soil vary greatly. In general, the soil grades toward Crosby silt loam on one extreme and toward Miami silt loam on the other. Consequently, in many places small areas of both

these soils are included. Probably the most important variation, however, is in the depth to calcareous till, which ranges between 15 and 40 inches. In the eastern part of the county, the soil has developed from relatively heavy textured till and is shallower and heavier textured, on the average, than it is elsewhere in the county. In places the surface soil is darker and contains more organic matter than normal.

Use suitability and management.—About 90 to 95 percent of this soil was cleared at the time of the survey. Probably 80 percent of the cleared land was used for cultivated crops, and the rest for permanent pasture.

The soil is comparatively low in organic matter but apparently is moderately well supplied with plant nutrients. Largely because of its relatively thick, moderately fine textured subsoil, it retains and supplies water well. Although the soil is subject to alternating wet and dry conditions, its water table is considerably lower than that in the Crosby soil. Roots penetrate readily. Permeability to moisture and air is ordinarily moderately good but is retarded somewhat during winter and early in spring when the soil is excessively wet and the water table is highest. The soil has good tilth and can be worked safely, except when too wet, with all types of farm machinery.

If properly managed, this soil is well suited to cultivated crops. Some of it has been artificially drained. Productivity over a long period of years probably could be increased by drainage, but drainage is not necessary to grow crops. The soil responds to good management, particularly fertilization and liming, and holds up well after it is improved. It ordinarily is not very susceptible to erosion and can be conserved easily under a relatively short rotation that contains at least 1 year of meadow. Although not so productive in wet years as Miami silt loam, undulating phase, it appears to be more productive in dry years. For a further discussion of use and management, see management group 5.

Celina silt loam, eroded undulating phase (2 to 5 percent slopes) (CD).—This light-colored, moderately well drained upland soil is similar to Celina silt loam, undulating phase, except that it is more eroded. The soil has lost 50 percent or more of its surface soil and up to 25 percent of its subsoil through accelerated sheet erosion. The present yellowish-brown heavy silt loam surface soil, to plow depth, commonly consists of a mixture of original surface and subsoil materials. In galled spots the yellowish-brown silty clay loam upper subsoil is exposed.

Use suitability and management.—All of this soil had been cleared and was being used for pasture or crops, principally crops, at the time of the survey. It is fairly well suited to cultivated crops, but measures should be taken to check erosion. Besides decreasing fertility and removing soil material, erosion has lowered the water-absorbing and water-supplying capacities, impaired tilth, increased runoff, and increased susceptibility to further erosion. For a further discussion on use and management, see management group 7.

Celina-Crosby silt loams, nearly level phases (0 to 2 percent slopes) (CG).—This mapping unit consists of the nearly level phases of two soils—the Celina and Crosby silt loams. The two are so intricately associated they cannot be separated on a map of the scale used.

Although the proportion of each soil varies considerably in each area of the complex, it is estimated that the Celina soil occupies about 65 percent of the total area, and the Crosby soil about 35 percent.

The Celina soil commonly occupies positions slightly above those of the Crosby. The Celina soil is moderately well drained; the Crosby is imperfectly drained. Surface runoff is slow on this complex, and accelerated erosion is very slight.

This complex typically occurs in moderately large areas. It is associated with the Miami and Brookston soils and with other Celina and Crosby soils. The profile and characteristics of Crosby silt loam, nearly level phase, are described on this page. Those of Celina silt loam, nearly level phase, are similar to those of Celina silt loam, undulating phase, described on page 39.

Use suitability and management.—At the time of the survey, an estimated 85 to 90 percent of this complex was cleared. Most of the cleared area was used for crops, and the rest was in pasture. Yields, on the average, are higher than on Crosby silt loam, nearly level phase, and lower than on Celina silt loam, undulating phase.

Much of this complex, principally the wetter areas occupied by the Crosby soil, is tile drained. Where adequately drained, this complex is well suited to the common tilled crops and pasture. However, it is not so well suited to alfalfa as the better drained soils. The soils of this complex respond to fertilizer and lime and hold improvements well. Because of the almost level relief, conservation of soil material is not a problem. Moderate productivity can be maintained by using a 4-year rotation that includes 2 years of legume-grass meadow, and by applying amendments. For a further discussion of use and management, see management group 6.

Crosby silt loam, nearly level phase (0 to 2 percent slopes) (Ck).—This imperfectly drained light-colored upland soil, locally called gray clay or white clay, has developed over calcareous glacial till. It has almost level relief, the slopes nowhere exceeding 2 percent. Surface runoff is slow to very slow, and internal drainage is slow. Although scattered areas of this soil occur in all parts of the county that are underlain by glacial till, they are most extensive on the level till plains in the northwestern and southeastern parts of the county. The soil is associated principally with the Brookston and Celina soils and with other Crosby soils in the Crosby-Brookston-Celina soil association.

Practically all the soil is uneroded or only slightly eroded. A few areas are covered with light-colored soil material washed from adjoining uplands. This is the most extensive soil in the county.

Profile description (pastured area):

0 to 7 inches, grayish-brown, faintly mottled with light brownish gray, silt loam; very friable; granular structure; medium acid.

7 to 11 inches, olive-brown, strongly mottled with light brownish gray, silty clay loam; breaks into small nutlike pieces; firm when moist and hard when dry; contains a few small, dark, iron concretions and sand grains; strongly acid.

11 to 17 inches, olive-brown, mottled with dark grayish brown and light brownish gray, silty clay loam; breaks into medium-sized irregular blocky pieces; plastic when wet, very firm when moist, and very hard when dry; strongly acid.

17 to 33 inches, mottled yellowish-brown, dark grayish-brown, and light brownish-gray clay loam; breaks into coarse blocky pieces; very firm

when moist and plastic when wet; becomes darker in color in lower 8 to 10 inches; contains numerous small dark iron concretions; slightly acid.

33 inches +, light yellowish-brown, mottled with light brownish gray, compact firm calcareous glacial till; light clay loam texture; massive structure.

Although the soil profile typically has distinct and well-differentiated horizons, especially as to texture, there is considerable variation in the thickness of the horizons and in depth to the calcareous parent material. In general, the parent glacial till is finer textured in the extreme eastern part of the county, and here, the soil is shallower and finer textured than normal. In other places the silt loam surface soil layers are thicker than normal but rarely exceed 15 inches.

The soil varies but slightly in color and in degree of mottling. Included, however, are small, scattered, very poorly drained areas that have a light brownish-gray silt loam surface soil and a highly mottled dark olive-gray and olive plastic clay subsoil. These included areas are typical Bethel silt loam, a soil not mapped separately in this county. They were included with this Crosby soil because of their small extent. Areas of Brookston soils too small to be shown on the map are included in places, especially in the northeastern part of the county.

Use suitability and management.—At the time of the survey probably 80 to 90 percent of the soil was cleared and artificially drained (pl. 4, *A*). Of these areas, more than 80 percent was used as cropland, and the rest for permanent pasture. Very little of the soil was idle.

This soil is medium to strongly acid, low in organic matter, and moderately well supplied with most plant nutrients. The periodically high water table and the dense subsoil, popularly called a claypan, restrict penetration of plant roots, percolation of water, and movement of air through the profile.

Although the soil is moderately fertile, its poor natural aeration retards crop growth. Adequate artificial drainage lowers the water table, promotes better aeration, and permits roots to penetrate more deeply. The water-holding capacity of the subsoil is good, but during dry years the surface soil dries out rapidly late in summer.

Tilth is good if the soil is worked when moist or dry. If worked when wet, however, the surface soil puddles badly and bakes and clods upon drying. The soil commonly dries out slowly in spring. Frequently it dries too late to allow early plowing for planting of corn. Because of its favorable relief, it is readily accessible to farm machinery except when too wet.

When adequately drained, this soil is moderately well suited to the production of the common crops. It is, however, less well suited to alfalfa and other crops highly sensitive to excessive soil moisture. Yields of all crops vary considerably according to the weather. In general, they are lowest in wet seasons and highest in dry seasons. Besides adequate drainage, good management practices should include proper liming and fertilization and use of a rotation designed to add organic matter and promote better soil structure and permeability. Artificial drainage should be designed to lower the water table and to remove excess surface waters from adjoining slopes. For a further discussion of use and management, see management group 6.

Crosby silt loam, gently undulating phase (2 to 5 percent slopes) (Ch).—This imperfectly drained, light-colored soil is similar to Crosby silt loam, nearly level phase. It differs in having greater surface runoff and a deeper, slightly coarser textured, mottled zone. The mottling usually is less pronounced than in the nearly level phase. Although relief ranges from 2 to 5 percent, most slopes have less than a 4 percent gradient. The soil is uneroded or only slightly sheet eroded. Scattered areas of Brookston soils too small to be shown on the map are included with this soil.

Use suitability and management.—At the time of the survey, probably more than 85 percent of this soil had been cleared and was being used for crops. Only a minor acreage was in pasture (pl. 5). If drained, this soil is moderately well suited to cultivated crops. Its management problems are similar to those of the nearly level phase but it probably is slightly more productive than that soil. Owing to the undulating relief, water ordinarily does not stand on the soil. It dries out and warms up more quickly in spring than the nearly level phase and is more accessible to farm machinery at that time. For a further discussion of use and management, see management group 6.

Eel silt loam (0 to 2 percent slopes) (Ea).—This grayish-brown, moderately well drained soil of the bottom lands has developed from calcareous stream alluvium that washed chiefly from uplands in the Late Wisconsin calcareous drift region. It has almost level relief. Surface runoff is very slow. Internal drainage is medium to slow, chiefly because of the periodically high water table. The soil occurs as moderately large, elongated areas and is in close association with the Genesee, Shoals, Sloan, and Wabash soils of the first bottoms. It occurs throughout the Sloan-Wabash-Genesee-Eel soil association but is most concentrated in the lower part of the valley of the Mad River. It is relatively inextensive.

Profile description (cultivated area):

0 to 19 inches, dark to very dark grayish-brown silt loam; very friable and smooth; weak granular structure; mildly alkaline.
19 to 25 inches, dark to very dark grayish-brown, mottled with grayish brown and light olive brown, friable silt loam; weak blocky structure; contains a few small pebbles and snail shells; mildly alkaline.
25 to 36 inches, light brownish-gray, mottled with olive brown, friable fine sandy loam; massive structure; contains a few snail shells; mildly to moderately alkaline.
36 inches +, light brownish-gray, clean, marly sand and fine gravel; calcareous.

The soil varies chiefly in surface texture, which in places is a fine sandy loam or loam. These variations are chiefly in the valley of the Mad River. Along many of the smaller streams, the soil is lighter colored in the upper, mottle-free layers.

Use suitability and management.—An estimated 70 to 80 percent of this soil had been cleared at the time of survey. About equal acreages of the cleared land were in crops and pasture. Some of the wooded areas also were pastured.

This soil is neutral to mildly alkaline and high in organic matter and plant nutrients. It is permeable to air and water; plant roots penetrate it easily. Moisture is absorbed readily, and air circulates freely in the upper mottle-free layers. Although the soil does not

have a high water-holding capacity, it receives much water from rainfall, underground waters, and occasional floods. Consequently, it has a high moisture-supplying capacity. Tilth is excellent over a wide range of moisture conditions, and the smooth relief favors the use of all farm machinery.

Susceptibility to flooding narrows the range of suitability of this soil. It is well suited to corn, soybeans, and water-tolerant grasses and legumes. It is less well suited to small grains because there is danger of flooding and because small grains tend to lodge on this fertile soil. Stands of alfalfa often are ruined or seriously damaged by flooding.

The soil is also very well suited to pasture because it has sufficient moisture and high fertility. Pasture grasses tolerate excessive moisture better than most crops and withstand prolonged flooding. Pastures on this soil commonly are more productive during dry summer weather than they are on the more droughty, light-colored, upland and terrace soils. Little or no lime or fertilizer is needed, and pasture management is concerned largely with improving quality through weed control and regulated grazing. For a further discussion of use and management, see management group 1.

Fox silt loam, nearly level phase (0 to 2 percent slopes) (Fr.). This well drained, deep, light colored, terrace soil is the most extensive of the soils developed over stratified calcareous gravel and sand deposited in the glacial outwash valleys. Locally, it is sometimes called chocolate land or waxy land. It is characterized chiefly by its brownish silt loam surface soil and reddish-brown clay loam subsoil that is moderately plastic and sticky when wet.

The relief is almost level; consequently, surface runoff is slow to very slow. Internal drainage, however, is medium to rapid, largely because the gravel-and-sand substratum is highly permeable.

The soil occupies moderately large to very large areas and is at slightly higher elevations than the closely associated Bronson, Homer, Westland, and Abington soils. It is largely in the Fox-Homer-Warsaw soil association, particularly in the valleys of the Mad and Little Miami Rivers and Buck Creek. The most concentrated areas are near and south of New Carlisle.

Profile description (cultivated area):

0 to 9 inches, brown to grayish-brown silt loam; very friable, smooth and floury; weak granular structure; slightly acid.

9 to 14 inches, brown silt loam; friable when moist; moderately developed medium angular blocky structure; slightly acid.

14 to 23 inches, reddish-brown clay loam; breaks to coarse nutlike pieces; firm when moist, hard when dry, and moderately plastic and sticky when wet; contains a few small glacial pebbles; slightly acid.

23 to 34 inches, dark reddish-brown clay loam; breaks to coarse nutlike pieces; very firm when moist, hard when dry, and moderately plastic and sticky when wet; contains a few small pebbles; medium acid.

34 to 38 inches, dark reddish-brown fine gravelly clay loam; weak coarse blocky structure; plastic and sticky when wet and very firm when moist; varies considerably in thickness from place to place; tongues often extend for short distances into the layers below; apparently contains appreciable quantities of organic matter, as compared to all layers except the first; slightly acid.

38 inches +, somewhat weathered, stratified, calcareous gravel and coarse sand that becomes less weathered and cleaner with increasing depth.

Within short distances, depth to the sand-and-gravel substratum varies from 28 inches to 45 inches. Although the soil typically occurs along the outer and somewhat elevated terraces of the glacial valleys, some of it is on lower and more inward terraces. The soil on the low terraces often has a browner and darker colored surface soil than typical, probably because of its higher organic-matter content. Some of it is neutral in reaction and is similar to the Warsaw soil.

Use suitability and management.—At the time of the survey, practically all of the soil had been cleared; about 85 percent was in cultivation, and the rest was in permanent pasture.

This soil is relatively low in organic matter, apparently moderately well supplied with most plant nutrients, and slightly to medium acid. It is readily permeable to roots, moisture, and air throughout its depth. Although water percolates freely, enough of it is retained in the clayey subsoil layers for the satisfactory growth of most crops in all except the dry seasons. Tilth is easily maintained under good management and is favorable over a wide range of moisture content. The soil commonly can be worked a few days after heavy and prolonged rains without puddling, baking, cracking, or clodding. Owing to its nearly level relief, it is easily accessible to all farm machinery.

Its predominantly favorable features make this soil well suited to crop production. Alfalfa, sweetclover, and winter small grains are especially well suited, as also are timothy, smooth brome, and other deep-rooted grasses. The principal unfavorable feature of the soil is its tendency to droughtiness in extremely dry growing seasons. It is therefore less well suited to drought-sensitive crops, such as corn, soybeans, and oats. Satisfactory yields of such crops, however, are obtained in normal or wet growing seasons.

If properly managed, this is a valuable and productive soil over a long period of years. It responds to good management and retains fertility well. If it receives enough fertilizer, lime, and organic matter, it can be conserved and kept productive by using a moderately short crop rotation. For a further discussion of use and management, see management group 2.

Fox silt loam, gently undulating phase (2 to 5 percent slopes) (Fp).—Undulating relief and a slightly shallower profile distinguish this well-drained, light-colored soil from Fox silt loam, nearly level phase. Its slightly stronger relief gives it greater runoff and a lower water-supplying capacity than the nearly level phase. Otherwise the two soils are essentially the same.

This soil occurs in the glacial valleys underlain by well-assorted calcareous gravel and sand. It is closely associated with other soils of the Fox series and with Westland, Abington, Homer, and Bronson soils. Although a few areas are on low terraces, most of this soil occupies the higher terraces. Some areas, especially those east of the junction of Buck and Beaver Creeks, have an irregular, hummocky relief.

Use suitability and management.—At the time of survey the acreage cleared and the proportion used for the various crops were about the same as for the nearly level phase. The soil is well suited to both cultivated crops and pasture but, because of its lower water-supplying capacity, it is probably slightly less productive than the nearly level

phase in growing seasons when the rainfall is low. This phase is more subject to erosion, but management requirements are similar for the two soils. For a further discussion of use and management, see management group 5.

Fox silt loam, eroded gently undulating phase (2 to 5 percent slopes) (FL).—This well-drained, light-colored terrace soil was derived from outwash gravel and sand. It resembles Fox silt loam, nearly level phase, but is more eroded and has stronger relief and a slightly thinner profile.

About 50 percent or more of the original surface soil and up to 25 percent of the subsoil have been lost through sheet erosion. In most places, the plow layer is brown friable silt loam, a mixture of the original surface soil and the subsoil. Galled spots, exposures of the reddish-brown clay loam subsoil, occur here and there.

Because of its eroded condition and stronger relief, surface runoff is more rapid on this soil than on the nearly level phase. The rapid runoff tends to lower the water-supplying capacity of the soil and to make it more susceptible to erosion. Erosion also has resulted in poorer tilth and decreased fertility and productivity.

This soil occurs chiefly on the higher terraces in close association with other Fox soils. A few areas are on the lower terraces. Areas east of the junction of Buck and Beaver Creeks have a more choppy, hummocky relief than is typical.

Use suitability and management.—At the time of the survey practically all of this soil had been cleared. It was used mostly for crops, but sizeable areas were in pasture. Under proper management, which includes adequate erosion control, the soil is moderately well suited to crops. It probably is slightly less productive than the gently undulating phase. For further discussion of use and management, see management group 7.

Fox silt loam, severely eroded gently undulating phase (2 to 5 percent slopes) (FV).—This eroded soil has a higher rate of runoff, a lower water-supplying capacity, poorer tilth, and lower fertility and productivity than Fox silt loam, nearly level phase. Accelerated sheet erosion has removed practically all of the original surface soil and more than 25 percent of the subsoil. Some small, shallow gullies occur in places.

The present surface soil, to plow depth, is brown or reddish-brown heavy silt loam or silty clay loam. In numerous spots the reddish-brown clay loam subsoil is exposed. The subsoil and deeper layers are thinner but are otherwise similar to those of the nearly level phase. A few areas have a hummocky relief, in contrast to the more even slopes elsewhere.

Use suitability and management.—All of this soil was once cleared and cultivated, although most of it was in pasture at the time of the survey. This soil probably is best suited to permanent pasture. For further discussion of use and management, see management group 10.

Fox silt loam, eroded sloping phase (5 to 10 percent slopes) (FM).—This phase differs from Fox silt loam, nearly level phase, chiefly in being moderately eroded and in having considerably stronger slopes. Other incidental differences are a somewhat thinner profile and a greater number of pebbles in the soil mass. Accelerated sheet

erosion has removed 50 percent or more of the original surface soil and up to 25 percent of the subsoil. In most places, the present surface soil, to plow depth, is a brown, heavy silt loam. Surface runoff is rapid.

Erosion has impaired tilth and decreased productivity. Surface runoff has increased because loss of the porous surface layer and the organic matter it contained has impaired the ability of the soil to absorb water. Consequently, the soil is subject to further erosion.

The soil occurs as narrow elongated areas, usually on terrace escarpments. It is not extensive. A few areas are only slightly eroded; these are mostly in forest or within the limits of a town.

Use suitability and management.—At the time of the survey most of this soil had been cleared and was in use as cropland or pasture. Only minor acreages were idle. Where adequate measures are taken to control erosion, this soil can be cropped, although it is only fairly well suited to such use. Permanent pastures do well when properly managed and may be the best use of this soil unless cropland is scarce. For a further discussion of use and management, see management group 8.

Fox silt loam, severely eroded sloping phase (5 to 10 percent slopes) (Fw).—A 7- to 9-inch layer of reddish-brown heavy silt loam or silty clay loam surface soil and sloping relief characterize this severely eroded, somewhat excessively drained, light-colored terrace soil that developed over outwash gravel and sand. It differs from Fox silt loam, nearly level phase, in being much more eroded and in having steeper slopes, somewhat thinner corresponding soil layers, and a greater pebble content. All of the original surface soil and more than 25 percent of the subsoil have been removed by accelerated sheet erosion, and small shallow gullies occur in places.

In its eroded condition, the soil has a rapid to very rapid surface runoff, partly because loss of its original porous surface layer and the organic matter it contained decreased the ability of the soil to absorb and hold water. Its tilth also has been seriously impaired.

The plow layer consists mainly of reddish-brown clay loam of the original upper subsoil. Much of the fertility has been lost, and productivity seriously lowered. The soil commonly occurs in narrow elongated areas on terrace escarpments.

Use suitability and management.—All of this soil has been cleared and cultivated. At the time of the survey, it was about equally divided between cropland and pasture, although a few acres were lying idle. Because of its slope and eroded condition, it is poorly suited to crops and is best used for pasture unless cropland is urgently needed. The soil reaction and natural fertility are favorable for the establishment of pasture grasses, which can be maintained under good mangement. For a further discussion of use and management, see management group 10.

Fox silt loam, nearly level deep phase (0 to 2 percent slopes) (Fs).—This soil developed over stratified, calcareous gravel and sand of the glacial outwash valleys. It is a deep, light-colored, well-drained soil on terraces. It is essentially similar to Fox silt loam, nearly level phase, but it differs in some particulars, chiefly in having a less reddish subsoil, thicker corresponding soil layers, and, consequently,

greater depth to the gravel-and-sand substratum. The substratum commonly begins 50 inches or more below the surface.

The almost level relief results in very slow to slow surface runoff, but internal drainage is medium, largely because of the porous nature of the gravelly substratum.

The soil occurs in medium-sized to moderately large areas and is in close association with the Bronson, Homer, Mill Creek, Westland, and Abington soils, and with other Fox soils. It is largely in the Fox-Homer-Warsaw soil association.

(Profile description (cultivated area) :

0 to 12 inches, grayish-brown to yellowish-brown silt loam; very friable, smooth, and floury; granular structure; slightly acid; in the virgin condition the upper 2 or 3 inches is dark grayish brown because of its organic-matter content.

12 to 17 inches, brown to yellowish-brown silty clay loam; breaks to small blocky pieces; moderately firm to friable when moist; medium acid.

17 to 32 inches, strong-brown clay loam; breaks to medium-sized angular blocky pieces; firm when moist and hard when dry; firmer consistence and considerable quantity of small gravel in lower 10 inches; medium acid.

32 to 42 inches, brown sandy clay loam; firm to very firm; weak coarse blocky structure; contains numerous small pebbles and some small gravel; medium acid.

42 to 50 inches, brown light sandy clay loam; firm when moist and slightly plastic and sticky when wet; considerably coarser textured and less firm than above layer; contains occasional pebbles; slightly acid.

50 inches +, yellowish-brown, stratified, calcareous gravel and sand.

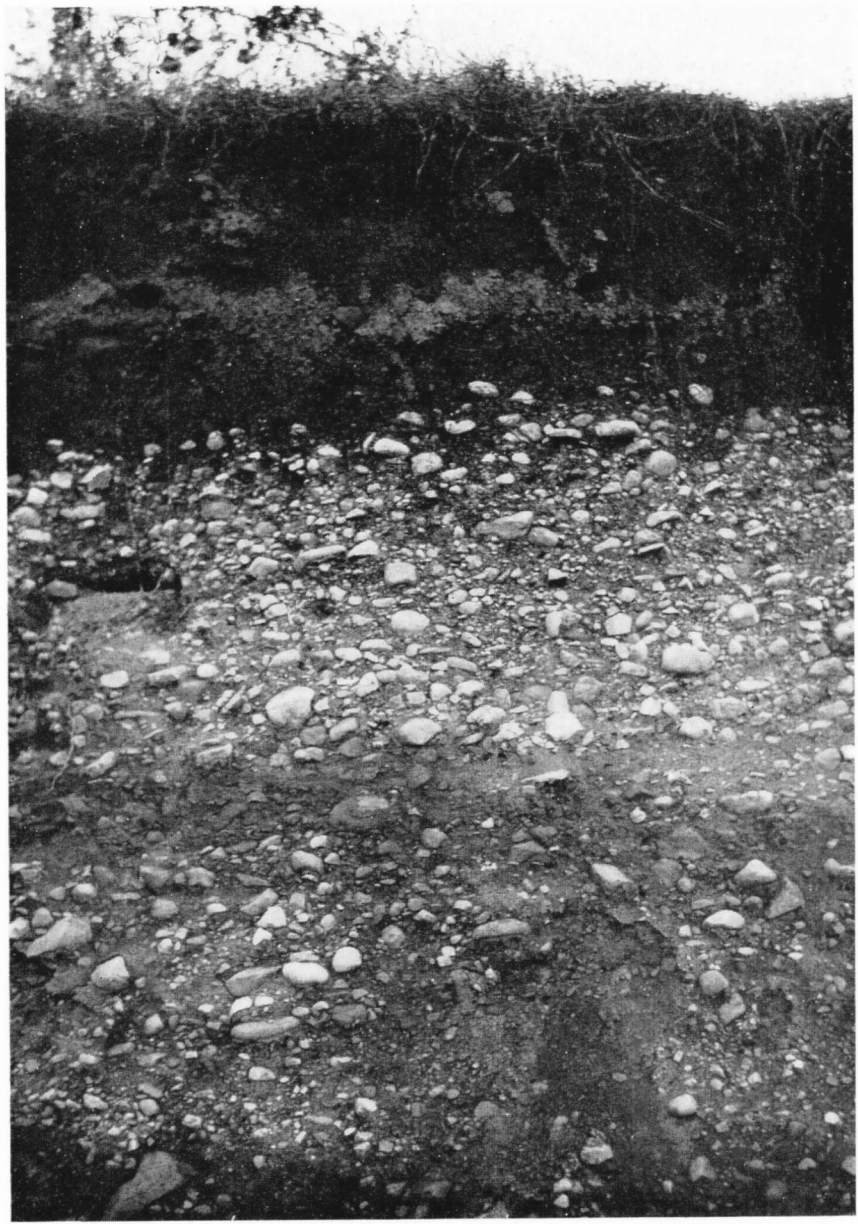
The soil varies chiefly in subsoil color, which in places is yellowish brown or yellowish red. Some areas immediately east of New Carlisle in the valley of Honey Creek overlie calcareous till or have, at a shallow depth, a gravel-and-sand substratum 1 to 2 feet thick that overlies glacial till. Apparently, the original deposits of sand and gravel in this area were relatively thin over glacial till. In places the soil is covered by thin deposits of light-colored material washed down from eroded adjoining slopes.

Use suitability and management.—At the time of the survey, practically all of this soil had been cleared. Some of it was used for pasture but by far the most of it was cultivated.

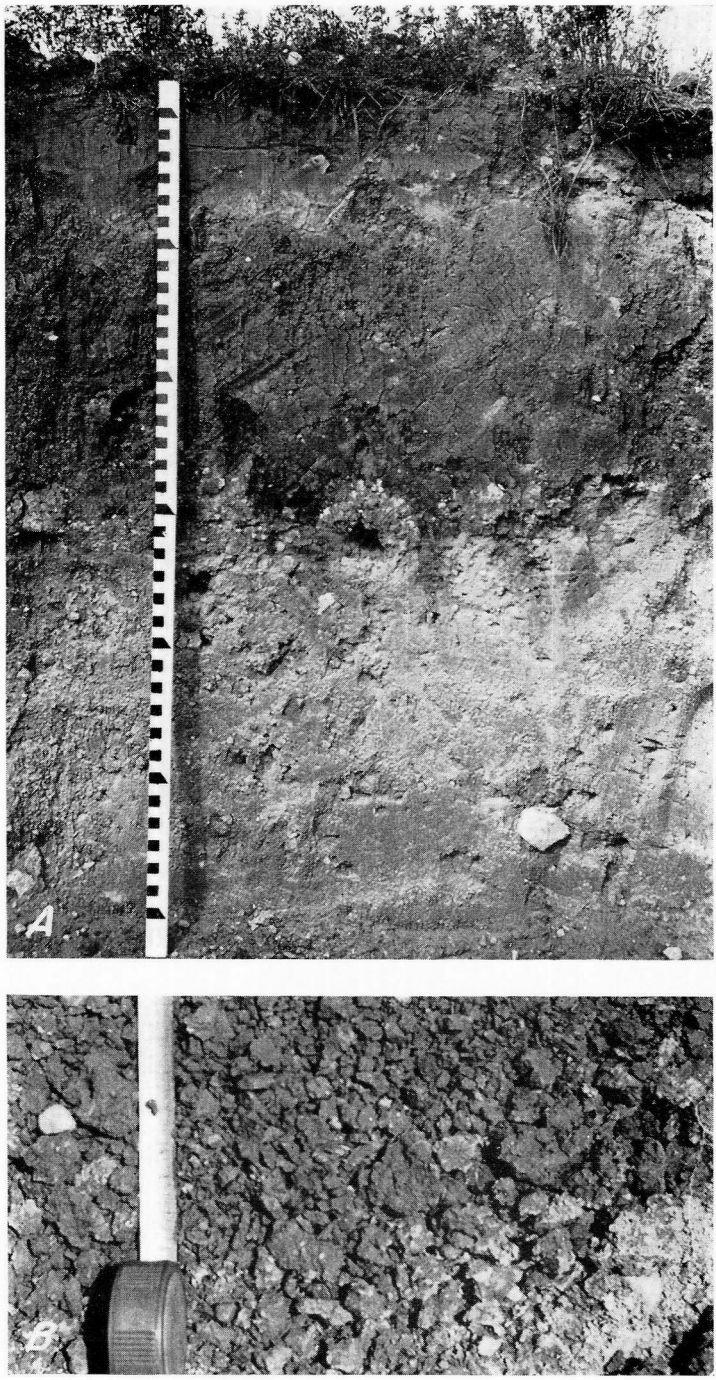
The soil is relatively low in organic matter but moderately well supplied with plant nutrients. The reaction commonly ranges from slightly acid to medium acid within the soil profile. The soil is favored with good tilth and excellent accessibility to farm machinery and is easily penetrated by plant roots. Moisture is readily absorbed, and air circulates freely throughout the soil. Principally because of its greater thickness, the soil has a higher water-holding capacity than the gently undulating phase of Fox silt loam, but it is similar in most other physical features. Erosion is not a problem.

This Fox soil is used and managed in the same way as Fox silt loam, gently undulating phase, but it probably is suitable for a wider range of uses and, because of its greater depth and better water-holding capacity, is more productive. Corn and other drought-sensitive crops are less injured by excessive drought than they are on other Fox soils. For a further discussion of use and management, see management group 2.

Dairy cattle grazing on timothy-red clover rotation pasture on the nearly level and gent



Profile of Fox silt loam, gently undulating shallow phase.



A, Profile of Miami silt loam, gently rolling phase.
B, Subsoil of a Miami soil showing subangular blocky structure.

Millsdale silty clay loam in foreground and Milton silt loam, eroded strongly sloping

Fox silt loam, gently undulating deep phase (2 to 5 percent slopes) (Fo).—Slightly stronger relief differentiates this phase from Fox silt loam, nearly level phase. Other differences are its greater surface runoff and somewhat lower water-supplying capacity. Otherwise, the two soils are similar.

Most of the soil has been slightly sheet eroded; small patches have been moderately eroded. Some scattered areas at the base of slopes are covered by 6- to 8-inch deposits of light-colored colluvial wash.

Use suitability and management.—At the time of survey, practically all this soil had been cleared and was being used as cropland, the use to which it is best suited. Many crops grown on this phase are likely to be affected by drought and, over a long period of years, produce slightly less. This soil should be protected against erosion and moisture loss resulting from excessive runoff. For a further discussion of use and management, see management group 5.

Fox silt loam, nearly level shallow phase (0 to 2 percent slopes) (Fu).—This somewhat excessively drained, shallow, light-colored, terrace soil has developed from stratified, calcareous gravel-and-sand deposits of the glacial outwash valleys. In most features it is similar to Fox silt loam, nearly level phase, except that it is considerably shallower and has thinner and more gravelly corresponding soil layers. The depth to the gravel substratum rarely exceeds 2 feet.

Surface runoff is slow to very slow because the soil is almost level. Internal drainage, however, is rapid to medium because of the gravel substratum. This soil occurs in the Fox-Homer-Warsaw soil association and is closely associated with the Westland and Abington soils, and with other Fox soils.

Profile description (pastured area):

0 to 8 inches, dark-brown or brown very friable silt loam; granular structure; neutral.
8 to 13 inches, brown (with a reddish cast) firm fine gravelly clay loam; breaks into nutlike pieces; neutral.
13 to 21 inches, dark reddish-brown, firm, fine gravelly clay loam; plastic and sticky when wet; breaks into nutlike pieces; neutral.
21 inches +, clean, stratified, calcareous gravel and sand; slightly weathered in upper few inches.

Use suitability and management.—At the time of the survey, most of this soil had been cleared and was being used as cropland or pasture. It is neutral or only slightly acid in reaction, and apparently moderately well supplied with plant nutrients, but relatively low in organic matter. It is easily penetrated by plant roots and air. Although much water is absorbed, it drains away fairly rapidly through the porous substratum. Moreover, the thin subsoil has a moderately low capacity to retain moisture. Often there is not enough moisture for plant growth in dry seasons. Tilth is good over a wide range of moisture content and is easily maintained under good management. The level relief and good drainage make the soil accessible to farm machinery at practically all times. Erosion is not a problem.

Largely because of its droughtiness, this soil is not so well suited to corn, soybeans, and other crops having high moisture requirements as is Fox silt loam, nearly level phase. It is fairly productive of these crops in seasons of sufficient rainfall and is a good soil for wheat,

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alfalfa, deep-rooted grasses, and other drought-resistant crops. For a further discussion of use and management, see management group 2.

Fox silt loam, gently undulating shallow phase (2 to 5 percent slopes) (FR).—This soil differs from Fox silt loam, nearly level shallow phase, principally in having stronger slopes. It also differs in having slightly thinner corresponding soil layers (pl. 6), a wider range in degree of erosion, greater surface runoff, and a slightly lower water-supplying capacity. Sheet erosion is slight over approximately 64 percent of the soil, moderate over 35 percent, and severe on 1 percent.

Use suitability and management.—Most of this soil was used as cropland or pasture at the time of the survey. It is moderately well suited to the production of cultivated crops but is probably slightly more droughty and less productive over a period of years than the nearly level shallow phase. Its use suitability and management problems are similar to those of the nearly level shallow phase, but the soil is more difficult to conserve and requires more attention to control loss of soil and water. For a further discussion of use and management, see management group 5.

Fox silt loam, eroded sloping shallow phase (5 to 10 percent slopes) (FN).—This soil of the terrace escarpments is similar to Fox silt loam, nearly level shallow phase, except that it has steeper slopes, is more eroded and shallower, and has more rapid surface runoff and a lower water-supplying capacity. This soil commonly occurs in long, narrow bodies. About one-half of it is moderately sheet eroded, and the rest is severely sheet eroded and somewhat gullied.

Included with the soil are several small areas having gravelly silt loam surface soils. These are indicated on the map by gravel symbols. A few scattered patches, underlain by sand, have loam or sandy loam surface soils.

Use suitability and management.—Practically all this soil has been cleared and cultivated. At the time of the survey, it was used about equally for pasture and crops. Because the soil is droughty, it is suitable only for deep-rooted crops or fast-growing crops that will mature during the short period when there is enough rainfall.

Largely because of its steeper slope and eroded condition, this soil is not nearly so well suited to cultivated crops as the nearly level shallow phase. Its crop yields also are lower. Erosion control is usually necessary to prevent further losses of soil material and fertility and to conserve water. Unless a great need for cropland exists, the soil is probably best used for pasture. For a further discussion of use and management, see management group 10.

Fox fine sandy loam, nearly level phase (0 to 2 percent slopes) (FB).—This soil was derived largely from stratified, calcareous sand and fine gravel deposited in the glacial outwash valleys. It is a well drained to somewhat excessively drained, moderately deep soil of the terraces. It resembles Fox silt loam, nearly level phase, in many profile features; it differs in having sandier, less silty corresponding soil layers. Surface runoff is slow, and internal drainage is medium to rapid. The soil is located in the Fox-Homer-Warsaw soil association. It is closely associated with the Westland and Ab-

ington soils, and with other Fox soils. It occupies relatively small areas, usually on the low terraces. The soil is affected only slightly, if at all, by accelerated erosion.

Profile description (cultivated area):

0 to 8 inches, yellowish-brown or brown fine sandy loam; very friable; weak granular structure; slightly acid.
8 to 14 inches, brown heavy fine sandy loam; friable; granular structure; medium acid.
14 to 22 inches, strong-brown light sandy clay loam; friable to firm when moist; medium nuciform structure; medium acid.
22 to 33 inches, strong-brown light sandy clay loam; firm to friable when moist and moderately plastic and sticky when wet; coarse subangular blocky structure; medium acid.
33 to 37 inches, dark yellowish-brown sandy clay loam; plastic and sticky when wet; weak coarse blocky structure; mildly alkaline.
37 inches +, stratified, calcareous sand and fine gravel.

Use suitability and management.—At the time of the survey, practically all this soil had been cleared and was in crops or pasture, principally crops.

This soil is slightly to medium acid and low in organic matter. Air circulates freely, and plant roots and moisture penetrate readily. Tilth is excellent and easily maintained, and the level relief is favorable for the use of all farm machinery.

Although the soil is moderately well suited to cultivated crops, its moderately low water-holding and water-supplying capacities often limit yields of some crops in dry years. Its problems of management are similar to those of Fox silt loam, nearly level phase, but it is subject to more severe leaching, requires more lime and fertilizer, and is less retentive of fertilizers and lime. For a further discussion of use and management, see management group 2.

Fox fine sandy loam, gently undulating phase (2 to 5 percent slopes) (FA).—Except for stronger slopes and more variable degree of erosion, this soil is similar to Fox fine sandy loam, nearly level phase. Most of it is only slightly sheet eroded, but in scattered patches sheet erosion is moderate.

Use suitability and management.—Practically all this soil had been cleared and was being used as cropland or pasture, principally cropland, at the time of the survey.

This soil is moderately well suited to cultivated crops, particularly drought-resistant crops such as winter small grains and deep-rooted legumes and grasses. Its moderately low water-holding and water-supplying capacities often result in low yields of corn, soybeans, and bluegrass in dry years. Compared to Fox silt loam, nearly level phase, it is less productive, more difficult to conserve, and has greater lime and fertilizer requirements. For a further discussion of use and management, see management group 5.

Fox gravelly loam, eroded sloping phase (5 to 10 percent slopes) (FE).—This somewhat excessively drained, moderately shallow, stony soil was derived from stratified, calcareous, outwash sand and gravel. It occurs on glacial valley escarpments—slopes between the first bottoms and terraces, between terraces of different elevation, or between terrace and upland levels. It differs from Fox silt loam, nearly level phase, chiefly in having stronger slopes; thinner, coarser textured, and

less distinct soil layers; and a slightly darker colored, coarser textured surface soil. It also differs in being considerably more eroded, shallower to the gravel substratum, and more stony.

The sloping relief encourages relatively rapid surface runoff, and the internal drainage is rapid. The subsoil is thin and the gravel substratum is porous. Sheet erosion ranges from slight to moderate. About two-thirds of the soil has lost more than 50 percent of its original surface soil. Gullies are normally absent.

The soil occupies narrow elongated areas and is associated chiefly with the Rodman soils and other Fox soils in the Fox-Homer-Warsaw soil association.

Profile description (cultivated area):

0 to 8 inches, brown to dark-brown friable gravelly loam; granular structure; pebbles are predominantly about 1-inch in diameter; neutral.
8 to 14 inches, brown gravelly clay loam; friable to firm when moist; slightly plastic and sticky when wet; neutral.
14 to 22 inches, reddish-brown gravelly light clay loam; breaks into nutlike pieces; plastic and sticky when wet and firm when moist; contains considerably more gravel and is coarser textured than above layer; neutral.
22 inches +, stratified, calcareous gravel and sand.

This soil varies chiefly in depth and in color of the surface soil. These differences are caused largely by differences in erosion. The uneroded or slightly eroded soil exhibits a dark-brown or dark reddish-brown gravelly loam surface soil about 9 inches thick. Where moderately eroded, the present surface soil to plow depth is a mixture of the remaining original surface soil and 3 or 4 inches of the upper subsoil. Other slight variations are differences in gravel content and in surface soil texture. The soil, however, is fairly consistent in depth to the substratum of gravel and sand, which lies about 20 to 28 inches from the surface.

Use suitability and management.—At the time of the survey, an estimated 60 to 70 percent of the soil had been cleared. The cleared acreage was used about equally for crops and pasture.

Rapid internal drainage and the moderately thin subsoil make the water-holding and water-suppling capacities of this soil relatively poor. Nevertheless, it is readily permeable to roots and moisture. Air circulates freely throughout the soil. A few pebbles are on the surface and in the soil, and in some places they are so abundant they interfere with cultivation. Otherwise, tilth is good over a wide range of moisture conditions. Because of its steep slope, the soil is not well suited to the use of heavy farm machinery.

The soil apparently is moderately well supplied with organic matter and plant nutrients and is normally neutral or mildly acid.

Permanent pasture is probably the best use for this soil. It is not well suited to cultivated crops because it is subject to erosion and has rapid surface runoff, poor workability, a shallow profile, low moisture-holding capacity, and a fairly high stone content. Moreover, its long narrow areas are too poorly proportioned for use as cropland or for management as individual units. Good pasture management should include adequate fertilization, particularly with phosphate, as well as controlled grazing and weed control. For a further discussion of use and management, see management group 10.

Fox gravelly loam, eroded gently undulating phase (2 to 5 percent slopes) (Fc).—This soil differs from Fox gravelly loam, eroded sloping phase, principally in having smoother slopes. It also differs in having less surface runoff; consequently, it absorbs and supplies slightly more water. The two soil profiles are similar.

On this soil accelerated sheet erosion ranges from slight to severe. About 50 percent of the soil area is only slightly eroded, and about 45 percent is moderately eroded. Stones in the surface soil somewhat interfere with cultivation.

Use suitability and management.—Practically all of this soil was used for pasture or crops at the time of the survey. Largely because of its moderate shallowness, stoniness, eroded condition, and relatively low capacity for holding and supplying water, this soil is only fair for crops that require cultivation. Corn often suffers from drought on this soil in dry years. The more drought-resistant clovers, grasses, and small grains are better adapted. Management practices should be directed toward increasing fertility, checking erosion, and conserving water. For a further discussion of use and management, see management group 7.

Fox gravelly loam, severely eroded sloping phase (5 to 10 percent slopes) (Fg).—This soil is similar to Fox gravelly loam, eroded sloping phase, except that it has lost all of its surface soil and more than 25 percent of its subsoil. Consequently, there has been an increase in surface runoff and a decrease in water-absorbing and water-supplying capacities. The present surface soil, to plow depth, is a brown or reddish-brown heavy gravelly loam or gravelly clay loam. It is composed largely of the original upper subsoil layer.

Use suitability and management.—All of this soil has been cleared and at some time been cultivated, but at the time of the survey, substantial areas were in permanent pasture. Erosion has affected the soil by decreasing the supplies of organic matter and plant nutrients, lowering productivity, and increasing susceptibility to further erosion. The soil is poorly suited to cultivated crops and is best used as pasture. Pastures do well. They tend to dry out during dry summer months but are comparatively productive if heavily fertilized and properly managed. For a further discussion of use and management, see management group 10.

Fox gravelly loam, eroded strongly sloping phase (10 to 15 percent slopes) (Ff).—This soil differs from the eroded sloping phase chiefly in having stronger slopes. Other differences, associated with the steeper relief, are its more rapid runoff, lower water-absorbing and water-supplying capacities, and somewhat thinner corresponding soil layers. Accelerated erosion ranges from slight to severe. More than 60 percent of the soil is moderately sheet eroded. Where moderately eroded, the surface soil, to plow depth, is commonly a brown, heavy gravelly loam. Where the soil is severely eroded, the surface layer is a reddish-brown gravelly clay loam.

This soil occurs on terrace escarpments—sloping areas between two levels of terraces, or sloping areas between terraces and the upland. Included are small patches having thinner profiles than normal.

Use suitability and management.—At the time of the survey about 20 percent of this soil was in forest, 50 percent in pasture, and 30 percent under cultivation. The soil is poorly suited to cultivated crops because it has steep slopes, very rapid runoff, high susceptibility to further erosion, poor accessibility to farm machinery, and relatively low capacity to absorb and supply water. It is best suited to pasture, which does well under adequate management. Little lime is needed. Good pasture management consists largely of proper fertilization and control of grazing and weeds. For further discussion of use and management, see management group 11.

Fox gravelly loam, moderately steep phase (15 to 35 percent slopes) (FD).—The profile is similar to that of the eroded sloping phase except that it contains somewhat thinner corresponding soil layers. Accelerated sheet erosion ranges from slight to moderate. More than 90 percent of the soil is uneroded or only slightly sheet eroded and has a dark-brown, friable gravelly loam surface soil about 9 inches thick. The steeper slopes of this soil probably make runoff more rapid than on the eroded sloping phase and also reduce the ability of this soil to absorb and retain water. Some areas of this moderately steep phase are less stony than normal.

Use suitability and management.—At the time of the survey, more than 90 percent of this moderately steep phase was in forest, and practically all of the cleared part was in permanent pasture. This stony soil is unsuited to cultivation because it has steep slopes, very rapid runoff, low water-supplying capacity, high susceptibility to erosion, and poor accessibility to farm machinery. It is better suited to pasture, but its tendency to droughtiness sometimes limits the growth of pasture grasses during dry summer months. Pasture management is concerned largely with proper liming, fertilization, weed control, and regulation of grazing. For further discussion of use and management, see management group 11.

Fox loam, gently undulating phase (2 to 5 percent slopes) (FH).—This soil has developed from stratified calcareous sands and fine gravel deposited at lower levels in the glacial outwash valleys. It commonly occupies somewhat rounded, relatively low but prominent rises. It is associated with Westland, Abington, Bronson, and Homer soils, and with other Fox soils. A medium amount of the rainfall is removed as surface runoff. Internal drainage is medium to rapid because the soil and substratum are porous.

The soil resembles Fox silt loam, nearly level phase, in most features but has stronger relief and, consequently, greater runoff and erosion. Its soil layers are sandier and less clayey than corresponding layers in Fox silt loam, nearly level phase. Also, this soil was derived from sandier and less gravelly parent material.

Accelerated sheet erosion ranges from slight to moderate. It is slight on 97 percent of the soil. This soil is in the Fox-Homer-Warsaw soil association.

Profile description (cultivated area):

0 to 14 inches, yellowish-brown or brown loam; very friable; granular structure; becomes heavier textured in lower 5 inches; slightly acid.

14 to 24 inches, brown or reddish-brown sandy clay loam; breaks into nut-shaped pieces; friable when moist and slightly hard when dry; slightly acid.

24 to 36 inches, reddish-brown clay loam; breaks into nut-shaped pieces; firm when moist and hard when dry; medium acid.
36 to 40 inches, dark reddish-brown sandy clay loam; firm when moist and plastic and sticky when wet; weak coarse blocky structure; layer varies considerably in thickness, and tongues of it often extend for short distances into the layers below; apparently contains more organic matter than all layers except the first; slightly acid.
40 inches +, somewhat weathered stratified, calcareous sand and some fine gravel; becomes cleaner with increasing depth.

The soil varies somewhat in depth to the sandy substratum. Included are scattered areas that have very fine sandy loam surface soils.

Use suitability and management.—Most of this soil was cleared and cultivated at the time of the survey; only minor acreages were in pasture.

The soil is medium acid, relatively low in organic matter, and only moderately well supplied with plant nutrients. It is very permeable to plant roots, and air circulates freely through the entire profile. Because it is sandy, the soil is subject to excessive leaching. It has good to fair water-holding capacity. It has somewhat lower natural fertility than Fox silt loam, nearly level phase.

The tilth of the soil is excellent over a wide range of moisture conditions and is easily maintained under good management. The soil is accessible to all farm machinery at practically all times.

The soil is well suited to cultivated crops. It is better suited to small grains and drought-resistant grasses and clovers than to crops having high moisture requirements. Its problems of management are similar to those of Fox silt loam, nearly level phase, but it is slightly less productive and probably requires more lime, fertilizer, and organic matter. For further discussion of use and management, see management group 5.

Fox loam, nearly level phase (0 to 2 percent slopes) (FK).—This soil differs from Fox loam, gently undulating phase, mainly in having smoother slopes. It has developed over stratified calcareous sands and some gravel deposited in the glacial outwash valleys. Because it is almost level, surface runoff is slow and accelerated erosion is slight. Internal drainage is moderately rapid because the soil profile and substratum are porous. This soil is in the Fox-Homer-Warsaw soil association, where it is associated chiefly with other Fox soils.

Because this soil is almost level, it has less runoff and probably a slightly higher water-supplying capacity than the gently undulating phase.

As mapped, this soil includes small areas that have fine sandy loam surface soils and some patches that are deeper to the substratum than normal.

Use suitability and management.—Practically all of this soil is cleared. At the time of the survey most of it was being cropped; only a small area was in pasture. It is well suited to most crops, particularly to small grains, alfalfa, and drought-resistant grasses and clovers. Corn and other crops that require much moisture often do well if rainfall is adequate, but they are adversely affected in dry seasons. The problems of management are similar to those of Fox silt loam, nearly level phase. This soil, however, is slightly less productive over a period of years and probably needs slightly greater quantities of amendments. For further discussion of use and management, see management group 2.

Genesee silt loam (0 to 2 percent slopes) (GB).—A brown or grayish-brown friable silt loam profile distinguishes this well-drained soil of the stream flood plains. The soil was derived from neutral to mildly alkaline alluvium, most of which has washed from uplands in the region covered by Late Wisconsin glacial drift. The soil is almost level, so surface runoff is very slow. Internal drainage is medium. The soil occurs on first bottoms throughout the county, but principally along lower Mad River. Most of it is in the Sloan-Wabash-Genesee-Eel soil association.

Profile description (pastured area):

0 to 13 inches, brown to dark grayish-brown silt loam; very friable; granular structure; upper inch or two has weak platy structure; mildly alkaline.
13 to 30 inches, dark grayish-brown heavy silt loam; friable to somewhat firm; weak medium subangular blocky structure; mildly alkaline.
30 to 53 inches, dark grayish-brown silt loam; friable; well-developed nuciform structure; horizon similar to that above except that it is distinctly more friable and lighter textured; midly alkaline.
53 inches +, dark grayish-brown, slightly mottled with yellowish brown, silty clay loam; slightly plastic and sticky when wet; weak medium subangular structure; contains numerous snail shells; calcareous.

The soil varies chiefly in color. Locally, especially along the smaller drainageways, it is a brown, strong brown, or yellowish brown. In such places, the soil consists principally of local alluvium washed from adjoining eroded well-drained uplands. On the average, the soil is darker colored than much of it is elsewhere in western Ohio. Local areas are more shallow than normal and are underlain by loose sand and gravel at depths of 24 inches or less.

Use suitability and management.—An estimated 80 percent of the soil was used for either cultivated crops or pasture at the time of the survey. Some of the wooded areas also were pastured.

This soil is neutral to mildly alkaline in reaction and well supplied with plant nutrients and organic matter. Because of the favorable relief, it is well adapted to the use of all farm machinery, and its friability and low clay content insure good tilth over a wide range of soil moisture. Its porous and relatively loose structure results in easy penetration of plant roots and moisture, and air circulates freely throughout the profile. Although its water table is low and its water-holding capacity is only moderate, the soil is so situated that it receives and absorbs much water from rainfall, adjoining slopes, and occasional floods. It is not susceptible to erosion, but some areas receive deposits of fine gravel and coarse sand from floodwaters. Materials rich in plant nutrients, organic matter, and lime are added periodically through flooding and help maintain fertility.

This Genesee soil is well suited to corn, soybeans, truck crops, grasses, and some clovers. It is less well suited to small grains and alfalfa because these crops are likely to be drowned out by spring floods and because small grains tend to lodge. Little or no fertilizer or lime is used for most crops. The soil is naturally adapted to bluegrass and white clover. Pastures of these plants produce high-quality forage if adequately managed. Good pasture management is largely a matter of weed control and control of grazing. For a further discussion of use and management, see management group 1.

Genesee loam (0 to 2 percent slopes) (GA).—This soil differs from Genesee silt loam mainly in having a loam texture throughout the

soil mass. It typically occurs in relatively narrow strips adjacent to the banks of the larger streams, principally on the banks of the Mad River. In such places, its position is leveelike and it is slightly higher and nearer the stream channel than the associated Eel, Shoals, Sloan, and Wabash soils or other soils of its own series.

As mapped, the soil includes small areas that have gravelly surface horizons and some patches having fine sandy loam or very fine sandy loam surface soils. The gravelly areas are indicated by gravel symbols on the soil map.

Use suitability and management.—At the time of the survey, practically all of this soil was used for crops or pasture. Its use generally depended on the use of the associated soils.

Compared with Genesee silt loam, this soil is more permeable to water, air, and roots. It is somewhat lighter colored because it contains less organic matter. Presumably, it also has a slightly lower supply of plant nutrients. The soil is subject to overflow, but, because of its leveelike position, is not under water so long as the associated soils of the bottom lands.

This soil probably is slightly less productive, but, in general, its use suitability and management requirements are the same as those for Genesee silt loam. For further discussion of use and management, see management group 1.

Gravel pits.[5]—Areas shown as gravel pits represent land from which the overlying soil layers have been removed or pushed aside and the sand and gravel mined for road building, concrete material, or various other uses. The gravel pits are largely in areas of Fox, Bellefontaine, or Wawaka soils, which have relatively clean and well-assorted gravel and coarse sand underlying their lower subsoils.

The areas range considerably in size. Some of the small pits are quarried only periodically for home use. Most of the larger ones are operated by commercial producers. The larger pits are outlined on the soil map, but the smaller ones are indicated only by symbol. The pits ordinarily have no use other than as sources of gravel and sand, but some of them contain water and may be used as fish ponds.

Homer silt loam (0 to 2 percent slopes) (HA).—This light-colored, imperfectly drained, deep soil is on terraces in the glacial valleys. It is underlain chiefly by stratified calcareous glacial outwash gravel and sand. Closely resembling the Crosby soils, it has a grayish-brown friable silt loam surface soil and mottled olive-gray and yellow-brown dense firm subsoil or claypan.

Although slopes range from 0 to 5 percent, more than 95 percent of them are less than 2 percent. Owing to the almost level and somewhat depressed relief, surface runoff is very slow.

Although the soil is underlain by porous gravel and sand, the dense impermeable subsoil and the periodic high water table cause internal drainage to be slow to very slow. The soil is uneroded or only slightly sheet eroded. A few areas at the base of slopes or along small drainageways have shallow overcoatings of light-colored silty alluvium.

Areas of the soil are scattered throughout the valleys of the principal streams, but the places where they are most concentrated are in the valleys of the Miami River drainage system. Typically the soil oc-

[5] See symbol under conventional signs on soil map.

curs as moderate-sized areas in close association with the Westland, Abington, Bronson, Mill Creek, Mahalasville, and Needham soils. It is largely in the Westland-Abington or the Mahalasville-Mill Creek-Needham soil association.

Profile description (cultivated area):

0 to 9 inches, dark grayish-brown when wet and light brownish-gray when dry, smooth silt loam; very friable; weakly developed medium granular structure; neutral.

9 to 16 inches, olive-brown, mottled with grayish brown and yellowish brown, heavy silt loam; friable and smooth; moderately developed medium subangular blocky structure; contains a few small, dark, iron concretions; slightly acid.

16 to 28 inches, mottled yellowish-brown, olive-gray, and light olive-gray clay loam; breaks to coarse blocky chunks; firm when moist and hard when dry; contains a few pebbles and iron concretions; medium acid.

28 to 37 inches, olive-gray, mottled with yellowish brown, fine gravelly clay loam; very firm when moist and slightly plastic and sticky when wet; very coarse weak blocky structure; less compact and more friable than layer above; slightly acid.

37 to 46 inches, mottled olive-gray, light olive-gray, and yellowish-brown gravelly clay loam; plastic and sticky when wet; massive structure; moderately alkaline.

46 inches +, clean, stratified, calcareous gravel and sand.

A few areas in the Honey Creek valley east of New Carlisle developed from thin deposits of stratified gravel and sand. The gravel and sand are underlain by unassorted glacial till. In many places, however, this variation of Homer soil directly overlies glacial till and has lower subsoil layers that apparently were derived from till.

Another major variation is along the North Fork of the Little Miami River, near and east of Thorps. Here, the soil was derived from calcareous silts and fine sands deposited by glacial slack water and is underlain by 1- to 3-foot layers of these materials. The silts and sands overlie well-assorted calcareous gravel and sand. This variation is somewhat more silty throughout the profile than the typical soil; it resembles Whitaker silt loam, as mapped elsewhere in western Ohio. It would have been mapped as such if it had occupied sufficient area and did not have a deep gravelly substratum. In its virgin condition, this soil has a thin, dark, surface layer high in organic matter, but this layer disappears under cultivation.

Use suitability and management.—At the time of the survey, an estimated 85 to 95 percent of this soil was cleared and drained to the extent that would permit cropping. Most of the cleared land was cultivated; little of it was used for pasture.

The soil is low in organic matter, apparently moderately supplied with plant nutrients, and normally slightly acid. If the soil is drained, the surface soil is porous and absorbs water readily, but the dense subsoil, or claypan, is relatively impermeable and retards water percolation, root penetration, and the circulation of air. The water table fluctuates greatly in wet and dry weather. The water-supplying capacity is high and sometimes excessive. Largely because the thick silty surface soil contains little clay, tilth is favorable over a fairly wide range of soil moisture conditions. Because of the level relief, erosion is not a serious problem, and the soil is accessible to farm machinery.

If adequately drained, this soil is moderately well suited to the common crops, but it needs good management for continued satisfactory

production. It is particularly suited to crops that require a lot of moisture, such as corn, soybeans, and some grasses. It is not well suited to alfalfa and other crops sensitive to prolonged excessive wetness. Good management is chiefly a matter of fertilizing, liming, and rotating crops so as to add organic matter to the soil. The soil requires management similar to that for Crosby silt loam but it is probably more productive when so managed. For a further discussion of use and management, see management group 6.

Kendallville silt loam, undulating phase (2 to 5 percent slopes) (KE).—This well-drained, moderately deep, light-colored, upland soil has developed chiefly from calcareous glacial till. It is similar to Miami silt loam, undulating phase, in most soil profile features. It differs in having more rapid internal drainage, slightly greater depth, a more reddish and plastic subsoil, and lighter textured, more porous, parent materials. In color and consistence, its subsoil resembles those of the Bellefontaine series.

In most places the soil is underlain by relatively light textured, somewhat pebbly, glacial till, but in places, especially along the valley walls, the parent material consists of layers of till alternating with layers of sand and gravel, or of relatively thin layers of gravel and sand over till. Practically everywhere, however, the soil is immediately underlain by till, and apparently from this material the lower part of its profile developed.

The soil is in the morainic areas of the northeastern and eastern parts of the county, largely on undulating knolls. Owing largely to the undulating relief, surface runoff is medium. Internal drainage is also medium, because of the porous substratum and the mildly elevated relief.

The soil is in close association with the Miami, Bellefontaine and Celina soils, and with other Kendallville soils. It occurs largely in the Miami-Kendallville-Celina-Crosby soil association, particularly in the northeastern part of the county.

Profile description (pastured area) :

0 to 9 inches, grayish-brown to brown very friable silt loam; weakly developed coarse granular structure; in the virgin condition the upper 4 or 5 inches is a dark grayish-brown, granular silt loam; slightly acid.

9 to 20 inches, brown, with a reddish-cast, heavy silty clay loam; breaks to well-developed subangular blocky pieces; friable when moist and slightly plastic when wet; distinctly smoother and contains less grit and sand particles than horizon below; medium acid.

20 to 30 inches, brown to reddish-brown clay loam; firm when moist and slightly plastic when wet; well-developed subangular blocky structure; contains a few scattered pebbles; strongly acid.

30 to 38 inches, brown to reddish-brown gritty clay loam; firm when moist and plastic and sticky when wet; moderately developed coarse blocky structure; contains considerable small gravel; medium acid.

38 inches +, yellowish-brown, gravelly calcareous till of clay loam texture; contains thin layers of fine gravel at lower depths.

In some places the soil apparently has not eroded, but in others it is slightly sheet eroded. The uneroded parts are largely in wooded or urban areas. A few scattered areas in the glacial moraines are relatively hummocky and choppy. A few other scattered areas, principally in kettle holes or slight morainal depressions, are almost level.

The soil profile varies only slightly. A few areas have a loam surface soil; others are shallower to glacial till than typical. Where the

soil is closely associated with the Bellefontaine and Miami soils, small areas of those soils are included with it in mapping.

Use suitability and management.—At the time of the survey, 80 to 90 percent of this soil had been cleared. Probably 75 percent of the cleared area was in cultivation, and 15 to 20 percent in pasture. The rest was in urban areas, in farmsteads, or idle.

The soil is not naturally well supplied with organic matter but it is moderately well supplied with most plant nutrients. It is acid in reaction. Roots and moisture penetrate readily, and air circulates freely throughout the profile. The soil dries out fairly rapidly after being saturated with water and has good tilth over a wide range of moisture content. Its undulating relief favors use of all farm machinery. The water-holding capacity is good, largely because the subsoil is moderately dense, thick, and clayey. In normal or wet seasons there is ordinarily enough moisture for the common crops.

If properly managed, this soil is well suited to most crops, including alfalfa. However, it needs fertilizing, liming, the return of organic matter, and use of a suitable crop rotation if it is to continue maximum production. Even if well managed, the soil holds so little moisture during dry seasons that it is not suitable for corn or other crops that use much moisture. It is particularly well suited to small grains, alfalfa, and drought-resistant clovers. Although it is moderately susceptible to erosion, it can be conserved under a 3- or 4-year rotation made up of corn, wheat, and meadow. Its productivity is lower than that of the dark-colored soils, largely because it is lower in natural fertility, in organic-matter supply, and in water-holding capacity. The soil is moderately well suited to pasture grasses and produces high-quality pastures if properly managed. For a further discussion of use and management, see management group 5.

Kendallville silt loam, eroded undulating phase (2 to 5 percent slopes) (KB).—A brown, heavy silt loam surface soil and a reddish-brown or brown clay loam subsoil characterize this moderately eroded, well-drained upland soil. It was derived from calcareous glacial till that contained lenses of gravel and sand.

Except for the effects of erosion, it is like Kendallville silt loam, undulating phase. Accelerated sheet erosion has removed 50 percent or more of the original surface soil and as much as 25 percent of the subsoil. A few areas are more severely eroded. In most places, however, the plow layer consists chiefly of original surface soil mixed with some material from the upper subsoil. A few shallow gullies occur in places. The loss of so much of the original surface soil has decreased the content of organic matter and plant nutrients, lowered the capacity to absorb and supply water, made the soil more erodible, and increased the difficulty of maintaining good tilth. Erosion also has narrowed the range of moisture conditions under which the soil can be tilled.

The soil is associated chiefly with other Kendallville and with the Miami, Celina, and Bellefontaine soils.

Use suitability and management.—All of this soil has been cultivated at one time or another, but some of it was used for pasture at the time of the survey.

Although the soil is eroded, it is moderately well suited to crops, including alfalfa. It must be managed carefully to minimize further erosion. Soil material and fertility can be conserved in a moderate-length rotation if all tillage is on the contour and amendments are applied. The soil is slightly less productive than Kendallville silt loam, undulating phase, but continued moderate crop yields depend on adequate management. For a further discussion of use and management, see management group 7.

Kendallville silt loam, gently rolling phase (5 to 10 percent slopes) (KC).—This well-drained, moderately deep, light-colored upland soil differs from Kendallville silt loam, undulating phase, chiefly in having stronger slopes, a higher rate of surface runoff, and somewhat thinner corresponding soil layers.

Use suitability and management.—At the time of the survey, most of this soil was in agricultural use. Probably most of the cleared land was being used for pasture. The kinds of crops grown and management practices used on this soil are similar to those of the undulating phase, but yields are slightly lower.

The soil is suited physically to the production of crops, but its stronger relief makes for more rapid runoff than on the undulating phase, and, consequently, lower water-supplying capacity and increased susceptibility to erosion. Proper management should include use of a moderately long rotation and engineering devices for erosion control. For a further discussion of use and management, see management group 8.

Kendallville silt loam, eroded gently rolling phase (5 to 10 percent slopes) (KA).—This soil differs from Kendallville silt loam, undulating phase, mainly in being more eroded and in having stronger slopes. Accelerated erosion, caused largely by more rapid runoff, has removed a considerable part of the original surface soil. Subsequent tillage has mixed the remaining surface soil with the upper part of the subsoil.

Erosion losses have been uneven, and in many spots the plow layer consists entirely of the original surface soil. In most places, the present surface soil is a yellowish-brown or brown, friable, heavy silt loam, and the subsoil is reddish-brown or brown firm clay loam.

Use suitability and management.—All of this soil has been cleared. Probably more than 75 percent of it was being used for cultivated crops at the time of the survey. The same crops were grown as on the undulating phase, but yields were somewhat lower.

The soil is suited to the production of crops. In general, its use suitability and management problems are similar to those of the undulating phase, but it presents greater problems in the conservation of soil and water. Its stronger and more eroded slopes cause more rapid runoff and a decrease in water-supplying capacity. This soil needs longer rotations than the undulating phase, more organic matter, adequate lime and fertilizer, contour tillage, and possibly engineering measures for erosion control. For a further discussion of use and management, see management group 8.

Kendallville silt loam, severely eroded gently rolling phase (5 to 10 percent slopes) (KD).—This upland soil has a brown or yellow-

ish-brown silty clay loam or heavy silt loam surface soil and a reddish-brown to brown clay loam subsoil. It is light-colored, well-drained, and severely eroded.

The soil is similar to Kendallville silt loam, undulating phase, but considerably more eroded and more strongly sloping.

Accelerated sheet erosion has removed all of the original surface soil and as much as 25 percent of the subsoil. The present plow layer consists mainly of what was originally the upper subsoil. The loss of soil by erosion has been uneven, and in many spots the plow layer still contains a considerable part of the original surface soil. A few shallow gullies occur in places. This rolling soil typically has choppy or hummocky relief.

Use suitability and management.—All of this soil was once in cultivation. At the time of the survey, most of it was still in cultivation but there was a significant acreage of pasture.

This soil has greater runoff, is more susceptible to further injury from erosion, absorbs less moisture, and is lower in organic matter than Kendallville silt loam, undulating phase. It also has less favorable tilth and is less accessible to farm machinery. Because of these features, it is not well suited to the production of tilled crops and probably is best used for pasture. High-quality, good-producing pastures are readily established by adequate liming and fertilization, weed control, and regulated grazing. Under grass vegetation, the soil absorbs water more readily and holds and supplies it well. For a further discussion of use and management, see management group 10.

Kokomo[6] **silty clay loam** (0 to 2 percent slopes) (KF).—A black silty clay loam surface soil and a mottled dark-gray and olive silty clay subsoil characterize this very poorly drained, deep, dark-colored upland soil that developed over calcareous glacial till. The soil is almost level and occupies depressions usually surrounded by Brookston soils. In many characteristics it is similar to the Brookston soils; it differs chiefly in being more poorly drained, having thicker and darker colored surface soil, a grayer subsoil, and greater depth to calcareous till.

Surface runoff is very slow and ponds sometimes persist after rains. Internal drainage is very slow because it is restricted by the high water table and impermeable, dense subsoil. The soil ordinarily is not affected by accelerated erosion, but a few areas along drainageways and in lower depressions have shallow coverings of lighter colored soil material washed down from eroded adjoining slopes. In most places, however, cultivation has mixed these overcoatings with the original surface soil down to the depth ordinarily reached by a plow.

The soil occupies moderately large areas scattered throughout the county, but most of it is in the Crosby-Brookston-Celina association in the southeastern part of the county.

Profile description (pastured area):

0 to 14 inches, black silty clay loam; readily crumbles to coarse well-developed granular aggregates; friable to firm when moist and moderately plastic when wet; relatively high in organic matter; in the virgin condition, a 1- to 2-inch black, friable, silt loam mucky layer is on the surface; mildly alkaline.

[6] Classified in previous Ohio soil surveys as the Clyde series.

14 to 22 inches, dark olive-gray to black, mottled with olive, silty clay; breaks to coarse nutlike pieces; firm when moist and plastic and sticky when wet; moderately high in organic matter; mildly alkaline.
22 to 40 inches, dark-gray, mottled with olive and dark olive gray, silty clay or clay; strongly plastic and sticky when wet; weak very coarse blocky structure; mildly alkaline.
40 inches +, mottled light-gray, light yellowish-brown, and dark-gray weathered compact calcareous till; clay loam texture; massive structure.

The soil is relatively uniform in all characteristics, but in certain places it has a thinner surface layer that is also somewhat lighter colored than typical. These areas resemble Brookston silty clay loam, though they are more poorly drained and have a more grayish subsoil.

Use suitability and management.—At the time of the survey, practically all the soil had been cleared and artificially drained. Most of it was being used for intertilled crops.

The soil has a number of desirable properties. It is neutral to mildly alkaline, has a high water-holding capacity, is relatively rich in organic matter and apparently is moderately well supplied with most plant nutrients, particularly nitrogen. Where adequately drained, the dark-colored, granular surface layers are permeable to roots and moisture and apparently are sufficiently aerated to allow satisfactory growth of crops in all except the excessively wet seasons. The subsoil, however, is much less pervious to water, roots, and air.

The soil is heavy and difficult to work, but its level relief permits the use of all types of farm machinery. The structure, however, is easily damaged if the surface soil is worked when wet or trampled by livestock before it has dried out. Under proper management, the surface soil stays relatively loose and granular largely because it contains organic matter that keeps the granular aggregates from compacting and causes them to fall apart under light to moderate pressure.

Where adequately drained, the soil is well suited to the common crops, particularly corn, soybeans, and hay. It is not so suitable for small grains, which tend to lodge. Clovers and winter small grains are often injured through heaving and winterkilling. Good management should include adequate drainage, proper fertilization, and use of a rotation designed to conserve fertility and maintain favorable soil structure. Erosion control is not a problem. When properly managed, the soil easily can be kept highly productive for the crops to which it is suited. In years of excessive rainfall, however, it frequently is too wet to produce satisfactorily. For further discussion of use and management, see management group 4.

Made land (M).—This land type consists of areas that have been filled in by cinders and debris of various sorts; areas leveled off for building sites and athletic fields; or areas stripped of their upper soil layers to provide materials for roadbeds.

Most of this land type is in or near Springfield. The largest area is in Springfield along Buck Creek, where the first-bottom lands have been filled in with cinders and other refuse to provide an automobile parking lot for factory workers. Ordinarily, this separation has little, if any, agricultural significance.

Mahalasville silty clay loam (0 to 2 percent slopes) (Ma).—This is a dark-colored, very poorly drained, deep soil of the glacial valleys

(pl. 4, *B*). It has developed from stratified calcareous silts and fine sands that contain some small pebbles. Commonly, it is underlain by 1 to 2 feet of this material, which, in turn, overlies stratified calcareous gravel and sand. The soil closely resembles Westland silt loam in most profile features. It differs chiefly in being siltier and smoother, in containing less grit, and in having finer textured parent material. The underlying substratum is relatively compact, dense, and impermeable. Consequently, the soil is more difficult to drain than the Westland soil.

This soil occupies comparatively large, low-lying, almost level areas in the upper valleys of the Little Miami River and its North and Lisbon Forks. Surface runoff is very slow. Internal drainage is also very slow because the water table is high and the subsoil and substratum are almost impervious. Although natural drainage is very poor, most of the soil has been artifically drained to the extent that will permit cropping. The soil is largely uneroded, but a few areas along ditches and drainageways or at the base of slopes have shallow coverings of light-colored soil material that washed from adjoining slopes. The soil occurs in close association with the Needham, Homer, and Mill Creek soils and is largely in the Mahalasville-Mill Creek-Needham soil association.

Profile description (cultivated area) :

0 to 7 inches, dark-gray to very dark-gray granular silty clay loam; friable to firm when moist; relatively high organic-matter content; neutral to mildly alkaline.

7 to 15 inches, very dark-gray, relatively smooth, heavy silty clay loam; breaks to strongly defined very small blocky pieces; firm when moist and slightly plastic and sticky when wet; relatively high organic-matter content; under artificial drainage the material is moderately permeable to moisture, air, and plant roots; neutral.

15 to 25 inches, grayish-brown, strongly mottled with dark gray and yellowish-brown, smooth silty clay; breaks into moderately large angular blocky pieces; very firm when moist and plastic and sticky when wet; contains numerous small, dark, iron concretions; neutral.

25 to 40 inches, yellowish-brown, strongly mottled with gray and dark gray, smooth silty clay; similar in structure and consistence to above horizon; neutral.

40 to 52 inches +, gray or brownish-gray, stratified, calcareous fine sand; contains a few small limestone or dolomite pebbles; ranges from 1 to 2 feet in thickness and overlies well-assorted calcareous gravel and sand.

The profile varies chiefly in texture and thickness of the layers and in depth to the parent material. In some places, the parent material is more pebbly than normal and somewhat resembles ordinary glacial till. A few areas of the soil have a silt loam surface soil.

Use suitability and management.—At the time of the survey, practically all of this soil had been cleared and artificially drained and was being used chiefly for cultivated crops.

This soil is neutral to mildly alkaline, has relatively large amounts of organic matter and nitrogen in the dark-colored layers, and is apparently fairly well supplied with most other plant nutrients. If the soil is drained, the fluctuating water table can be kept low enough to permit satisfactory growth of common crops. Nevertheless, the dense, compact, plastic, and often waterlogged subsoil is relatively impermeable to moisture, roots, and air.

This heavy soil is difficult to work, especially when wet. Cultivation at proper moisture content is essential to prevent puddling and

clodding of the surface soil. The almost level relief favors the use of all farm machinery whenever the soil is dry enough.

If it is drained this soil is well suited to corn, soybeans, alsike clover, and meadow and pasture grasses. Where properly managed, it is highly productive of these crops in normal seasons. Small grains, alfalfa, and clover are somewhat less well adapted. The grains tend to lodge and to be injured by heaving and winterkilling. The soil is almost level, so it is not subject to erosion and is easily conserved. It is well suited to bluegrass and whiteclover and produces good yields of high-quality forage if it is properly managed. In general, it requires use and management similar to those for Westland silty clay loam. The Westland soil probably has a slight advantage in productivity because it can be more easily drained and it is less compact and plastic. For a further discussion of use and management, see management group 4.

Miami silt loam, undulating phase (2 to 5 percent slopes) (MM).—This well-drained, light-colored, moderately deep, upland soil is one of the most extensive in the county. It has developed from unassorted calcareous glacial till and is associated with the Celina, Crosby, Brookston, Kokomo, Kendallville, and Bellefontaine soils. It closely resembles Kendallville silt loam, undulating phase, but its internal drainage is less rapid and its subsoil is more yellowish brown and less plastic; also, the soil is slightly shallower and was derived from less pebbly, finer textured till.

Although it is widely distributed throughout the county, this soil is most extensive in the morainic areas in the northeastern, north-central, central, and extreme northwestern parts of the county. Red clay or brown clay are local names often given to the soil.

This undulating soil commonly lies a few feet higher than the closely associated Celina and Crosby soils. Many of the slopes are the hummocky irregular type typical of morainic relief. Surface runoff and internal drainage are medium because the soil and its parent material are permeable and the relief is favorable.

This soil is largely in the Miami-Kendallville-Celina-Crosby soil association. Its areas range from small to moderately large.

Profile description (cultivated area):

0 to 7 inches, light yellowish-brown or yellowish-brown silt loam; very friable and fairly smooth; weakly developed granular structure; in the virgin condition, the upper 2 inches is a dark grayish brown; slightly acid.

7 to 12 inches, yellowish-brown silty clay loam; breaks to well-defined nutlike pieces (subangular blocky structure); friable when moist; strongly acid to medium acid.

12 to 23 inches, brown to yellowish-brown heavy clay loam; firm when moist and moderately plastic when wet; strongly developed medium subangular blocky structure; somewhat finer textured and more firm and plastic in lower 4 or 5 inches; contains a few small scattered limestone pebbles; medium to strongly acid.

23 to 28 inches, dark yellowish-brown clay loam; firm; moderately developed coarse subangular blocky structure; contains some small limestone pebbles; neutral.

28 inches +, light yellowish-brown loam (calcareous glacial till); firm to friable and compact; moderately alkaline.

From place to place, the soil varies slightly in texture, structure, and thickness of its various layers. In some places the subsoil is more

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yellowish than normal and in others it is more reddish and approaches the reddish-brown color of the Kendallville and Bellefontaine subsoils.

In the western part of the county, especially where it adjoins areas of Milton soils, this soil may be underlain by limestone bedrock at depths of 3½ feet or more. Many areas in the eastern part of the county have a shallower profile than that described and the layers are correspondingly thinner and slightly finer textured. These areas appear to have been derived from glacial till that was finer textured than normal.

About 90 percent of the soil is slightly sheet eroded. There are no gullies. A few areas near the base of slopes have a thicker surface soil than normal because light-colored colluvial wash has been deposited.

Use suitability and management.—At the time of the survey, an estimated 85 to 95 percent of the soil had been cleared. Probably more than 75 percent of the cleared land was in cultivation, and the rest was used for permanent pasture.

In its virgin state, the soil apparently was moderately well supplied with plant nutrients, low in organic matter, and slightly to moderately acid. It is readily permeable to plant roots and moisture and is well aerated throughout. Largely because it has a fairly thick moderately fine textured subsoil, it holds water moderately well. In normal or wet seasons it supplies enough water for satisfactory crop growth. In dry seasons, however, some crops suffer from drought.

Soil tilth is favorable over a fairly wide range of moisture conditions, and the undulating relief permits relatively easy use of all farm machinery. Under good management, the soil is not very susceptible to erosion.

The soil is well suited to the common field crops, including alfalfa. Because it is inherently less fertile and has a lower water-supplying capacity, its productivity for corn and soybeans is lower than that of the dark colored soils. With proper management, however, it can be used for a wider range of crops.

Winter small grains, alfalfa, and clovers do well when the soil is adequately limed and fertilized. They are less subject to heaving and winterkilling than they are on the less well drained soils. The soil is fairly well suited to oats because it dries quickly in spring and permits early seeding. Oats are usually seeded in corn stubble. Corn is probably the most common crop, although it is only moderately well suited to this soil. Inadequate moisture during the dry growing seasons often limits corn yields.

The soil is very responsive to good management and holds added fertilizers well. For continued satisfactory production, it needs fertilizer, lime, and organic matter and a suitable rotation of adapted crops. For a further discussion of use and management, see management group 5.

Miami silt loam, nearly level phase (0 to 2 percent slopes) (MH).—This soil has developed from relatively thin deposits of calcareous glacial till that overlie limestone at depths of 3½ feet or more. It is a well-drained, moderately deep, light-colored upland soil much like Miami silt loam, undulating phase. It differs from that soil

mainly in having smoother slopes. Although it is almost level and was derived from glacial till—a combination that favors development of poorly drained soils—it is well drained because the underlying limestone is permeable. Surface runoff is slow.

The soil is closely associated with the Milton, Randolph, and Celina soils, and with other Miami soils. It is in the Miami-Kendallville-Celina-Crosby soil association. The largest concentrations of this soil are southwest of Springfield adjacent to the Mad River gorge. In some places where the limestone substratum appears to be lacking, the soil has developed over a pebbly till porous enough to permit good underdrainage, even though the relief is level.

Use suitability and management.—Probably more than 90 percent of this Miami soil is used for crops or pasture. Its use suitability and problems of management are similar to those of Miami silt loam, undulating phase, except that it is more accessible to farm machinery, has a higher water-supplying capacity, and is less subject to erosion. For a further discussion of use and management, see management group 2.

Miami silt loam, eroded undulating phase (2 to 5 percent slopes) (ME).—This moderately eroded, light-colored, deep, well-drained upland soil has a yellowish-brown or brown heavy silt loam surface soil. It was derived from calcareous glacial till. Except for the effects of erosion, it is like Miami silt loam, undulating phase. Accelerated sheet erosion has removed 50 percent or more of the original surface soil and, in places, as much as 25 percent of the subsoil. In most areas, however, the plow layer consists principally of original surface soil material. In a few scattered patches that are more severely eroded, the original subsoil is now exposed.

Because of erosion, this soil has higher runoff, somewhat lower capacity to absorb and supply water, and less favorable tilth than the undulating phase. It is also more subject to further erosion. These less favorable features have adversely affected the productivity of the soil.

Use suitability and management.—All of this soil has at one time or another been cleared and cultivated. At the time of the survey most of it was used for crops, but some areas, especially the more eroded, were in pasture.

The soil is suited to the production of cultivated crops, but great care must be taken to control further erosion. Soil material and water can be conserved by use of a 4-year rotation containing 2 years of meadow, adequate application of amendments, and contour cultivation. Engineering erosion-control devices, such as terraces, strip-cropping, or field diversions, also may be necessary, especially on the longer and more eroded slopes. The soil is better suited to small grains, grasses, and legumes than to corn, soybeans, or similar crops. Yields are in large measure dependent on the moisture available during the growing season. Average yields are lower than on the undulating phase, but the soil can be built up to and kept at a good level of productivity by using good management practices. For a further discussion of use and management, see management group 7.

Miami silt loam, gently rolling phase (5 to 10 percent slopes) (MF).—In this phase are the rolling, uneroded or slightly sheet-eroded

areas of Miami silt loam. The soil differs from Miami silt loam, undulating phase, chiefly in having stronger slopes and slightly thinner corresponding soil layers (pl. 7, *A* and *B*). Because of the steeper slopes, the soil also has greater runoff, is more subject to erosion, and has a slightly lower water-supplying capacity. To plow depth, the soil is a light yellowish-brown friable silt loam. The subsoil is a brown or yellowish-brown firm clay loam. Most of the soil occupies slopes bordering streams and drainageways, but some of it is on the hummocky, irregularly sloping morainal areas.

Use suitability and management.—A considerable area of this soil has never been cleared. At the time of the survey some of the cleared land was used for crops but probably most of it was in permanent pasture. The kinds of crops and the general farming practices that prevail are similar to those of the undulating phase. Yields, however, are somewhat lower on this gently rolling phase.

The soil is suited to crop production but its stronger relief causes it to be more susceptible to erosion and to excessive runoff than the undulating phase. It presents more exacting management problems. In general, the same principles of crop rotation and fertilization apply, but this soil should be kept in close-growing crops for longer periods and should be cultivated on the contour. Terraces, stripcropping, field diversions, or similar means of erosion control also may be necessary. For a further discussion of use and management, see management group 8.

Miami silt loam, eroded gently rolling phase (5 to 10 percent slopes) (MB).—This moderately eroded, light-colored, well-drained, upland soil was derived from calcareous till. It differs from Miami silt loam, undulating phase, mainly in having stronger slopes, in having slightly thinner corresponding soil layers, and in being considerably more eroded.

Accelerated sheet erosion has removed 50 percent or more of the original surface soil. Tillage has mixed the remaining surface soil with the upper part of the subsoil. In most places the plow layer is a yellowish-brown, friable, heavy silt loam. The subsoil is a brown, firm clay loam. The soil typically occurs on slopes or escarpments along streams and drainageways, but some of it is in morainal areas where the relief is hummocky.

Use suitability and management.—At the time of the survey, practically all of this soil had been cleared and most of it was being used for crops. It is suited to the production of the common crops, including alfalfa, but yields are lower than on the undulating phase.

Largely because of the rolling slopes and moderate erosion, the soil has greater runoff, lower capacity to absorb and supply water, decreased accessibility to farm machinery, poorer tilth, and greater susceptibility to further erosion than the undulating phase. Management should be directed toward increasing and maintaining productivity through adequate use of soil treatments, suitable rotation of adapted crops, and other practices needed to insure conservation of soil material and water. For a further discussion of use and management, see management group 8.

Miami silt loam, severely eroded gently rolling phase (5 to 10 percent slopes) (MK).—This is a severely eroded, well-drained, light-

colored, upland soil derived from calcareous glacial till. It is like Miami silt loam, undulating phase, except that it has stronger slopes and thinner soil layers and is eroded.

All of the original surface soil and more than 25 percent of the subsoil have been removed by accelerated sheet erosion. The present surface soil is yellowish-brown, friable, heavy silt loam or silty clay loam. The subsoil is brown firm to friable clay loam. Although erosion losses have been somewhat uneven, in most places the plow layer consists almost entirely of original subsoil material. A few shallow gullies occur here and there; several small, scattered spots are severely gullied.

This soil, for the most part, occupies slopes along streams and drainageways, but some occurs in morainal areas where the slopes are of the irregularly sloping, hummocky type.

Use suitability and management.—All of this soil has been cleared and cultivated. At the time of the survey there was a significant acreage of pasture, but most of the soil was used for cultivated crops.

The soil is not well suited to crops that require cultivation. Its rolling slopes and severely eroded condition result in susceptibility to excessive runoff and further erosion, decreased accessibility to farm machinery, poor tilth, and decreased capacity to absorb and supply water. The soil is suitable for pasture and should be so used unless great need for cropland exists. Good pastures are readily established and maintained under a management that includes adequate liming and fertilization, weed control, and regulated grazing. For a further discussion of use and management, see management group 10.

Miami silt loam, eroded rolling phase (10 to 15 percent slopes) (MD).—This soil differs from Miami silt loam, undulating phase, chiefly in being more eroded and in having considerably stronger slopes and somewhat thinner corresponding soil layers. It also has a slightly more reddish subsoil; this color is partly caused by the more rapid drainage. The present surface layer is commonly a yellowish-brown, friable, heavy silt loam; the subsoil is a brown or reddish-brown, firm, clay loam.

In most places, 50 percent or more of the original surface soil and as much as 25 percent of the subsoil have been removed by sheet erosion. The plow layer, however, is composed largely of original surface soil material. A few shallow gullies occur in places. Although the soil typically occurs on uniform slopes along streams and drainageways, a few areas in the glacial moraines have irregular hummocky relief.

Included with the soil, as mapped, are areas having reddish-brown, relatively plastic subsoils similar to those of the Kendallville soils. These areas are largely on the rolling moraines of Pleasant Township and are underlain in most places by coarse-textured glacial till or alternating layers of till and gravel and sand. A few areas, largely in woods, are uneroded or only slightly sheet eroded.

Use suitability and management.—About 10 percent of this soil has never been cleared of its oak-hickory type of forest. The cleared areas were used largely as pasture at the time of survey.

The soil is not well suited to crops because of its steep slope, eroded condition, low water-absorbing and water-supplying capacities, high

susceptibility to excessive runoff and further erosion, inferior tilth, and poor accessibility to farm machinery. It is well suited to pasture. Pasture grasses reduce runoff, aid in controlling erosion, and increase the capacity of the soil to absorb and supply water. Good pastures can be established and maintained by proper liming, fertilization, controlled grazing, and the suppression of weeds. For a further discussion of use and management, see management group 11.

Miami silt loam, severely eroded rolling phase (10 to 15 percent slopes) (ML).—This phase is similar to Miami silt loam, undulating phase, except that it has stronger slopes, thinner soil layers, and a more reddish-brown subsoil, and has been eroded. Accelerated sheet erosion has been severe, and in places there are a few shallow gullies. Practically all of the surface soil and more than 25 percent of the subsoil have been lost. The present surface soil, to plow depth, consists mainly of what was formerly upper subsoil material; it is a brown or yellowish-brown, friable to firm heavy silt loam or silty clay loam. The subsoil is a brown or reddish-brown firm clay loam. Along drainageways, uniform slopes are typical, but some areas in the glacial moraines have an irregular, hummocky type of relief.

As mapped, this soil includes areas having a relatively plastic reddish-brown subsoil that is similar to that of the Kendallville soils. These areas are largely underlain by calcareous glacial till containing lenses of sand and gravel. They occur, for the most part, in the rolling morainal areas in the northeastern part of the county. A few scattered severely gullied patches also are included.

Use suitability and management.—All of this soil has been cleared and cultivated. At the time of the survey some of it was cultivated and small areas were idle, but most of the soil was in permanent pasture.

The soil is steep and too susceptible to erosion and excessive runoff to be suitable for tilled crops. It is better suited to permanent pasture. High-quality and satisfactorily producing pastures can be obtained and maintained by adequate fertilization and liming and control of weeds and grazing. For a further discussion of use and management, see management group 11.

Miami silt loam, hilly phase (15 to 35 percent slopes) (MG).—This Miami soil occupies steep slopes and escarpments along streams and drainageways, especially those in the glacial outwash valleys. As compared to Miami silt loam, undulating phase, it has much stronger slopes, thinner corresponding soil layers, and more red in the subsoil. The surface soil is a yellowish-brown friable silt loam, and the subsoil a brown or reddish-brown firm clay loam. The soil is uneroded or only slightly eroded.

Some of the soil has reddish-brown, relatively plastic, deeper subsoil layers that resemble those of the Kendallville soils. These areas appear to be underlain by calcareous glacial till that contains thin gravelly and sandy layers.

Use suitability and management.—At the time of the survey, most of this soil had never been cleared of its oak-hickory forest. Areas that had been cleared were largely in permanent pasture.

Because this soil has steep slopes, it is subject to erosion and has very rapid runoff, a comparatively low water-supplying capacity, and

poor accessibility to farm machinery. It is not suited to cultivated crops but is fairly well adapted to pasture. Pastures of good quality and yield can be established and maintained through adequate application of amendments, regulated grazing, and weed control. Although the steep slopes often limit or prevent the use of mowing machines, weed growth can be regulated to a great extent by proper use of soil treatments and controlled grazing. With such practices, the pastures can be expected to improve in quality with age. For further discussion of use and management, see management group 11.

Miami silt loam, eroded hilly phase (15 to over 35 percent slopes) (Mc).—This excessively drained, light-colored, upland soil was derived from calcareous glacial till. It is similar to Miami silt loam, undulating phase, except it has a thinner profile, stronger slopes, and a more reddish-brown subsoil. It also differs in being much more eroded. Because slopes are strong, runoff is very rapid. The capacity of the soil to absorb and supply moisture is poor, and it is very susceptible to erosion. Accelerated sheet erosion ranges from moderate to severe. About 60 percent of the soil is severely sheet eroded. In most places the present surface soil is yellowish-brown or brown heavy silt loam or silty clay loam, and the subsoil is a reddish-brown or brown firm clay loam. Considerable areas have a few shallow gullies, and in some places the soil is severely and deeply gullied.

Although most of this soil occupies escarpments bordering streams and drainageways, some is on the irregularly sloping, hummocky relief of the morainal areas. Probably the most extensive areas of this soil are along the valley walls of the Mad River and Buck Creek.

As mapped, the soil includes small areas underlain by glacial till and alternating thin beds of gravel and sand. In these areas, the subsoil is more reddish-brown than typical and more plastic in the lower part.

Use suitability and management.—Most of this soil, including all of the severely eroded areas, has been cleared of its original oak-hickory forest. Some areas were used for crops at the time of the survey, but most of the soil is in pasture.

This phase is unsuited to cultivated crops because of its steep relief, excessive runoff, susceptibility to further erosion, and poor accessibility to farm machinery. It is moderately well suited to permanent pasture. Problems of pasture management are the same as for the hilly phase, but this eroded phase has more runoff, is more droughty, and is slightly lower in productivity. Moreover, pastures are more difficult to establish than on the hilly phase. For a further discussion of use and management, see group 11.

Mill Creek silt loam, nearly level phase (0 to 2 percent slopes) (Mo).—This well-drained, deep, light-colored terrace soil has developed on glaciofluvial outwash plains and valley trains. It resembles Fox silt loam, nearly level phase. It differs from that soil in being deeper, in having slightly less rapid internal drainage, and in being less red and more yellow in the subsoil. The calcareous, gravelly underlying material, locally called dirty gravel, contains an appreciable quantity of silt and clay, in contrast to the clean, well-assorted gravel and sand underlying the Fox soils.

The soil occurs in moderately large nearly level areas. Surface runoff is slow because of the smooth relief. Internal drainage is medium, largely because the substrata are porous and there is no high water table.

Accelerated erosion ranges from none to slight. More than 90 percent of the soil is slightly sheet eroded.

The soil occurs mainly in the upper valley of the North Fork Little Miami River and in an old glacial valley near Dolly Varden. It is associated principally with the Fox, Bronson, Mahalasville, and Needham soils and is largely in the Mahalasville-Mill Creek-Needham soil association.

Profile description (cultivated area):

0 to 8 inches, grayish-brown to dark grayish-brown, very friable, smooth fine granular silt loam; neutral.
8 to 17 inches, yellowish-brown, friable, smooth, medium granular silt loam; slightly acid.
17 to 26 inches, yellowish-brown silty clay loam; firm when moist; breaks to well-developed medium-sized irregular blocky pieces; medium acid.
26 to 39 inches, yellowish-brown clay loam; firm when moist and hard when dry; compact; moderately developed irregular blocky structure; very firm gravelly clay loam in lower 5 inches; medium acid.
39 to 46 inches, dark-brown gravelly clay loam; slightly plastic and sticky when wet and firm when moist; massive structure; slightly acid.
46 inches +, light yellowish-brown, poorly assorted, calcareous gravel and sand containing some silt and clay.

Included with the soil are small areas of soil derived from and immediately underlain by thin slack-water deposits of calcareous silt, fine sand, and some small pebbles. These underlying materials range from 1 to 2 feet in thickness and are, in turn, underlain by well-assorted calcareous gravel and sand. The soils of these areas are slightly siltier than normal and resemble the Markland soils mapped in western Ohio. Some areas at the base of upland slopes are in terrace depressions have thicker surface soils than typical, as a result of additions of colluvial wash deposited through erosive processes.

The soil is slightly acid, apparently moderately low in organic matter, and fairly well supplied with most plant nutrients. It is porous and permits free penetration of water, plant roots, and air. Tilth is excellent over a wide range of moisture conditions, and the soil usually can be worked safely within a few days after heavy and prolonged rains. Because it is almost level, the soil is not susceptible to accelerated erosion and is accessible to all types of farm machinery. Internal drainage is medium, but in normal seasons the soil retains sufficient water for the satisfactory growth of most crops. It has higher moisture-holding capacity than Fox silt loam, undulating phase, as it is deeper and has less rapid underdrainage. Nevertheless, in dry seasons, it is somewhat droughty for corn and soybeans.

This Mill Creek soil is well suited to the common crops and is especially suitable for alfalfa and small grains. Corn and pasture plants sometimes suffer from drought. The soil responds to good management and appears to retain the effects of good management. Use and management problems are essentially similar to those for Fox silt loam, nearly level phase. For a further discussion of use and management, see group 2.

Mill Creek silt loam, gently undulating phase (2 to 5 percent slopes) (MN).—Undulating relief and a slightly thinner soil profile

distinguish this well-drained, deep, light-colored terrace soil from Mill Creek silt loam, nearly level phase. It also has somewhat more rapid runoff and a correspondingly lower capacity for absorbing and supplying water. Accelerated sheet erosion is slight in most places, but a few areas have lost most of their original surface soil.

Mapped with this soil are areas southeast of Thorps that are underlain by and apparently derived from silts and fine sands. Ordinarily the silts and sands are underlain by poorly assorted sand and gravel at depths of more than 4 feet. These areas have a siltier and smoother soil profile than typical.

Use suitability and management.—At the time of survey the acreage cleared and the area used for the various crops were about the same as for the nearly level phase. The soil is well suited to pasture and alfalfa or other crops. Probably it is slightly less productive than the nearly level phase, as it has a lower water-supplying capacity and is more erodible. It is readily conserved, however, by using a moderately short rotation that includes at least 1 year of meadow. It is a productive soil under adequate management. For further discussion of use and management, see group 5.

Millsdale silty clay loam (0 to 2 percent slopes) (Mp).—This dark-colored, very poorly drained upland soil has developed from shallow deposits of calcareous glacial till that lie over limestone bedrock. It is closely associated with the Milton and Randolph soils (pl. 8.). In many features it is similar to Brookston silty clay loam. It differs from that soil in having more plastic and sticky lower subsoil layers and in being underlain by limestone bedrock, usually at depths of 3 feet or less.

Typically this soil occupies almost level slightly depressed upland areas at the heads of drains and along small drainageways. Surface runoff is very slow. Internal drainage is also very slow because the subsoil is dense and the water table is high.

The soil occupies small to medium-sized areas in the Milton-Randolph-Millsdale soil association. It occurs principally in the Jackson Creek valley east of New Carlisle, along the Mad River gorge southwest of Springfield, and along the headwaters of Clear Creek.

Profile description (cultivated area):

0 to 9 inches, black to very dark-gray silty clay loam; slightly plastic when wet and friable to firm when moist; well-developed coarse granular structure; high in organic matter; neutral.

9 to 17 inches, very dark-gray to black heavy silty clay loam; breaks to medium-sized blocky pieces; firm when moist and slightly plastic and sticky when wet; relatively high in organic matter; neutral.

17 to 32 inches, dark-gray silty clay mottled with olive and light yellowish brown; plastic and sticky when wet; contains a few weathered limestone or dolomite fragments in lower few inches; mildly alkaline.

32 inches +, limestone (dolomite) bedrock.

The soil varies chiefly in the nature of its parent material and in depth to bedrock. Many small areas have 12 to 15 inches of black silty clay loam directly overlying limestone. In other places the bedrock is 36 inches or more from the surface. Much of the soil occupies terrace positions in the glacial valleys. Here, it is derived from and underlain by a shallow layer of highly weathered gravel and sand that abruptly overlies limestone bedrock. These terrace areas resemble Westland or Abington soils but differ in having bedrock about 3 feet from the surface.

Use suitability and management.—At the time of the survey an estimated 75 to 85 percent of this soil had been cleared for agriculture. Most of the cleared land is used for cultivated crops.

The Millsdale soil is relatively high in organic matter and nitrogen, and it apparently is moderately well supplied with other plant nutrients. It is nearly neutral in reaction. It is fine textured and of rather poor tilth, especially when wet, but its relief favors the use of all farm machinery. The subsoil is usually wet and waterlogged during winter and early in spring. Frequently the soil dries out too late to permit early spring plowing. Where the soil is of sufficient depth, it is usually tile drained. Tiling is not practical where the limestone is near the surface. When drained, the dark-colored surface layers are normally pervious to water, roots, and air. The dense subsoil is more slowly permeable. Water-supplying capacity is high to excessive. Owing to the almost level relief, the soil is not susceptible to accelerated erosion, but some depressed areas at the base of slopes are covered with shallow layers of light-colored colluvial wash.

When adequately drained, the soil is well suited to most of the common crops. It is especially well suited to corn, soybeans, and pasture and meadow grasses. It is less suitable for small grains, which sometimes lodge. Winter small grains, alfalfa, and clover may be damaged by heaving and winterkilling. When the soil is sufficiently drained, its use and management requirements are similar to those of Brookston silty clay loam. For further discussion of use and management, see group 4.

Milton silt loam, gently sloping phase (2 to 5 percent slopes) (Mv).—This light-colored, well-drained, moderately deep upland soil has a yellowish-brown silt loam surface soil and a brown (with a reddish cast) plastic, dense, clay subsoil. In most areas the soil profile developed partly from calcareous glacial drift and partly from limestone bedrock, which usually is 34 inches or more from the surface.

Slopes range from 2 to 5 percent but commonly are less than 3 percent. They are sufficient to provide medium surface runoff. Internal drainage is medium because the limestone bedrock is fairly close to the surface and fractured and permeable. The soil is uneroded or only slightly sheet eroded and contains no gullies.

The soil is closely associated with the Millsdale and Randolph soils and with other Milton soils. It occurs less extensively with some of the Miami soils and with Steep land-limestone outcrop. Like all the Milton soils, it is in the Milton-Randolph-Millsdale soil association and occurs only in the western half of the county.

Profile description (cultivated area):

0 to 9 inches, yellowish-brown, friable, granular silt loam; strongly acid; in the virgin condition, the topmost 3 to 4 inches is grayish-brown very friable silt loam of weak platy structure.

9 to 18 inches, brown heavy silty clay loam with a reddish cast; well-developed, medium-sized subangular blocky structure; firm when moist and moderately plastic when wet; contains a few small scattered limestone fragments; strongly acid.

18 to 34 inches, dark yellowish-brown to reddish-brown clay or clay loam; firm to very firm when moist and strongly plastic and sticky when wet; small weathered fragments of limestone are numerous, especially in the lower part; slightly acid.

34 inches +, limestone (dolomite) bedrock, weathered and partially decomposed.

The profile varies mainly in depth to bedrock. Bedrock may be 18 inches to 40 inches from the surface. In all places, however, the limestone is near enough to the surface to have contributed soil material and to have made the lower subsoil plastic, sticky, and tough.

Mapped with this soil is a large part of the city of Springfield adjacent to Buck Creek, as well as several areas in the Mad River valley west and northwest of Springfield. In these areas, the soil is on glacial outwash terraces and has developed from both thin deposits of stratified gravel and sand and from the underlying limestone bedrock. The soil in these areas resembles Fox silt loam soils in the upper part of the profiles, but it is underlain at shallow depths by limestone, and immediately over this bedrock has the plastic, tough, subsoil layers characteristic of the Milton soils. The areas would have been mapped as a terrace phase of the Milton soil if they occupied sufficient area to justify separation on the map.

Use suitability and management.—At the time of the survey, practically all of this soil had been cleared. More than 60 percent of it was in the city of Springfield, about 35 percent was used for cultivated crops, and about 5 percent was in permanent pasture.

The profile is acid in reaction, except for a few inches immediately above the bedrock that is neutral or mildly alkaline. The soil is apparently moderately well supplied with plant nutrients but low in organic matter. It is readily permeable to roots and allows free percolation of water and circulation of air. Tilth is good over a wide range of soil moisture conditions, and the soil dries out early in the spring. The relief is favorable for use of all types of farm machinery. Surface stones are lacking, and the few stones in the soil mass do not interfere with cultivation or plant growth. The soil is unusual in being well drained and at the same time having medium capacity for absorbing and retaining moisture. Chiefly because it has favorable relief, it is ordinarily not very susceptible to accelerated erosion.

The soil is well suited to cultivated crops, if properly managed. It is less suitable for corn and soybeans than the dark-colored soils but it is better for small grains, alfalfa, and clovers. The relatively high moisture-holding capacity, dense well-drained subsoil, and alkaline reaction of the lower subsoil layers make the soil especially well suited to alfalfa and deep-rooted clovers. Lime is needed for these legumes.

Management requirements are similar to those of Miami silt loam, undulating phase, but this Milton soil has a slight advantage in productivity during dry seasons. It responds to and retains the effects of good management. Fertility and soil material can be conserved in a 3- or 4-year rotation consisting of corn, wheat, and meadow, provided lime, fertilizer, and organic matter are applied. The soil is well suited to pasture grasses. It produces pastures of excellent quality and high carrying capacity if it is properly managed. Pasture management is largely a matter of proper fertilization, weed control, and controlled grazing. For further discussion of use and management, see group 5.

Milton silt loam, nearly level phase (0 to 2 percent slopes) **(Mx).**—This well-drained, light-colored, upland soil differs from Milton silt loam, gently sloping phase, chiefly in having milder relief and slightly

thicker soil layers. The surface soil is a yellowish-brown silt loam. The subsoil is a dark yellowish-brown or reddish-brown, firm to very firm clay or clay loam. On the average, the depth to limestone bedrock is greater than in the undulating phase. Because of the almost level relief, surface runoff is slow and erosion is negligible or slight. There are no gullies.

Use suitability and management.—Practically all of this soil has been cleared of its original oak-hickory forest. Most of it was used as cropland at the time of survey.

The soil is well suited to cultivated crops and pasture. Its management requirements are similar to those of Milton silt loam, undulating phase. It is slightly more productive, however, as it has a higher water-supplying capacity and is less subject to erosion. It has excellent qualities of tilth, and its level relief and good drainage make it easily accessible to all farm machinery. For a further discussion of use and management, see group 2.

Milton silt loam, eroded gently sloping phase (2 to 5 percent slopes) (MR).—This phase of Milton silt loam differs from the gently sloping phase chiefly in being somewhat eroded. Moderate sheet erosion has removed 50 percent or more of the original surface soil and as much as 25 percent of the subsoil. The loss of soil material, however, has been uneven over the area. In a few places, remnants of the original surface soil have been mixed with the subsoil through tillage operations. Consequently, the present surface soil is variable in color, texture, and thickness. It is predominantly a yellowish-brown or brown friable silt loam. The subsoil consists of a dark yellowish-brown or reddish-brown firm to very firm clay loam or clay. Surface runoff is medium to rapid.

Use suitability and management.—Nearly all of this soil had been cleared and was being cultivated at the time of the survey. Yields are slightly lower than on Milton silt loam, gently sloping phase.

The soil is suited to the production of cultivated crops, including alfalfa, but needs good management practices to check erosion and to maintain its moderately good productivity. As a result of moderate erosion, the soil has lost a considerable part of its original supply of organic matter and plant nutrients. Furthermore, tilth has been impaired and the rate and volume of water absorption have been decreased. Productivity has been lowered and susceptibility to further erosion intensified.

Besides adequate application of amendments, management practices should include use of a moderately long rotation, return of more organic matter to the soil, and contour tillage. A 4-year rotation that includes 2 years of meadow is well suited. For further discussion of use and management, see group 7.

Milton silt loam, eroded sloping phase (5 to 10 percent slopes) (MS).—This well-drained, light-colored, moderately deep, upland soil has developed from shallow, calcareous glacial drift that was deposited over limestone bedrock. It has a yellowish-brown or brown friable silt loam surface soil and a brown or reddish-brown firm to very firm clay or clay loam subsoil.

This soil is much like Milton silt loam, gently sloping phase. It differs in having stronger slopes, in being generally more eroded, and

in having slightly thinner corresponding soil layers and a shallower depth to bedrock. Accelerated sheet erosion has been slight to moderate. More than 60 percent of this phase is moderately sheet eroded; that is, it has lost 50 percent or more of the original surface soil and up to 25 percent of the subsoil. Even in the eroded areas, however, the plow layer consists mainly of original surface soil material. Gullies are not common.

Use suitability and management.—More than 65 percent of this soil was used as cropland or pasture at the time of the survey. The uncleared area, largely uneroded or only slightly sheet eroded, is covered by an oak-hickory type of forest. Crop yields are generally lower than on the gently sloping phase.

Because of its stronger slopes and more eroded condition, this soil has more rapid runoff, lower water-absorbing and water-supplying capacities, greater susceptibility to further erosion, less favorable tilth, and poorer accessibility to farm machinery than the gently sloping phase. Consequently, it also has a narrower range of crop suitability and is more difficult to manage. For continued productivity, this soil needs a moderately long rotation, adequate applications of amendments and organic matter, contour tillage, stripcropping, and terraces or field diversions. For a further discussion of use and management, see group 8.

Milton silt loam, severely eroded sloping phase (5 to 10 percent slopes) (MY).—This severely eroded, well-drained, light-colored, upland soil differs from Milton silt loam, gently sloping phase, principally in having stronger slopes, in being considerably more eroded, and in having thinner corresponding soil layers. Losses of soil material through erosion have been relatively great. In most places, the original upper subsoil is exposed. The plow layer is commonly a brown heavy silt loam or silty clay loam, and the subsoil is a brown to reddish-brown firm to very firm clay or clay loam. Gullies are usually shallow and occur only locally.

Use suitability and management.—Although all of this soil has been cleared and cultivated at some time, most of it was in permanent pasture at the time of the survey.

Because of its stronger slopes and severe erosion, this phase has more rapid runoff, greater susceptibility to erosion, lower capacity to absorb and supply water, poorer tilth, and poorer accessibility to farm machinery than the gently sloping phase. The soil is unsuitable for cultivated crops but moderately well suited to pasture. Pastures of good quality and yield are readily established and maintained by adequate application of amendments, regulated grazing, and weed control. For further discussion of use and management, see group 10.

Milton silt loam, eroded strongly sloping shallow phase (10 to 35 percent slopes) (MU).—This is a light-colored, shallow, excessively drained, upland soil derived from shallow calcareous glacial till overlying limestone bedrock. Bedrock is normally less than 2 feet below the surface. This soil is considerably shallower than Milton silt loam, gently sloping phase, and its horizons are more stony and less distinct in regard to color and texture.

Because of the strongly sloping relief, surface runoff is rapid to very rapid. Internal drainage is rapid because the soil is shallow and because the soil and underlying limestone are permeable.

There is a considerable variation in degree of erosion. Wooded areas are largely uneroded; cleared areas are moderately to severely sheet eroded. Gullies are usually shallow and inextensive.

The soil occupies escarpments along the streams and larger drainageways. Most of it is along the valley walls of the Mad River southwest of Springfield.

Profile description (pastured area):

0 to 9 inches, yellowish-brown to brown, friable, granular silt loam; contains numerous small flat limestone fragments; mildly acid.
9 to 17 inches, brown friable silty clay loam or heavy silt loam; contains numerous small limestone fragments; mildly acid to neutral.
17 to 24 inches, brown to yellowish-brown friable stony silt loam; neutral.
24 inches +, limestone (dolomite) bedrock.

Included with this soil are many areas that appear to have been formed in place, and entirely from residuum weathered from limestone. Presumably, little if any glacial material has remained for soil development. These areas are more stony than typical and are indicated on the soil map by stone symbols.

Use suitability and management.—At the time of survey probably 75 percent of this soil was in use, principally for permanent pasture. Minor acreages were in cultivation or lying idle.

This soil is unsuited to cultivated crops because of its shallowness, rapid runoff and susceptibility to erosion, low capacity to absorb and hold water, and very poor accessibility to farm machinery. It is fairly well suited to pasture but is only moderately productive in dry seasons because it tends to be droughty. With adequate amendments, regulated grazing, and weed control, good-quality pasture can be maintained. The steep slopes make mowing difficult or impossible. For a further discussion of use and management, see group 11.

Milton silt loam, gently sloping shallow phase (2 to 5 percent slopes) (Mw).—This moderately shallow, well-drained, light-colored upland soil was derived from very shallow calcareous glacial drift overlying limestone bedrock. It is like Milton silt loam, eroded strongly sloping shallow phase, except that it has smoother slopes and is less eroded and slightly deeper to bedrock. Moreover, in many places, the soil has a 4- to 8-inch, reddish-brown, firm clay loam subsoil layer that is not characteristic of the eroded strongly sloping shallow phase.

Because of the favorable relief, surface runoff is not rapid. The soil absorbs considerable water but does not hold it very well because it is shallow and permeable.

The soil is slightly to moderately sheet eroded. In most places the plow layer, mainly the original surface soil, is a brown or yellowish-brown friable silt loam. Loose fragments of limestone are on the surface in places. Where these stones interfere with cultivation, they are indicated on the soil map by stone symbols. One small area contains a number of rock outcrops, which are also shown by map symbols.

Use suitability and management.—Most of this soil has been cleared and used for pasture, the use for which it is best suited. It is con-

sidered too shallow and too droughty to be suitable for tilled crops. Pastures require management similar to that for the eroded strongly sloping phase, but this soil is more accessible to mowing machines and other farm equipment and is probably more productive during droughts. For further discussion of use and management, see group 11.

Milton silt loam, eroded sloping shallow phase (5 to 10 percent slopes) (MT).—Milder relief distinguishes this shallow, light-colored, well-drained, upland soil from Milton silt loam, eroded strongly sloping shallow phase. In addition, this soil is slightly deeper to bedrock, is less stony, and in places contains a reddish-brown firm clay subsoil layer 4 to 8 inches thick.

Degrees of erosion are variable. Wooded areas are largely uneroded or only slightly sheet eroded; most of the cleared areas are moderately sheet eroded and in a few places are more severely eroded. Gullies are shallow and inextensive. They occur principally on the areas more severely sheet eroded.

Use suitability and management.—About 20 percent of this soil has never been cleared. A small part of the cleared land was in cultivation at the time of the survey, but probably more than 75 percent of it was being used for pasture.

Largely because it is shallow and has a low water-holding capacity, this soil is poorly suited to crops that require cultivation. When cultivated, it is subject to moderately rapid runoff and erosion. In places, stones interfere with tillage. The soil is moderately well suited to permanent pasture. Pastures tend to dry out on it during midsummer droughts but will maintain good quality and good average yields if amendments are applied, weeds are controlled, and grazing is regulated. For a further discussion of use and management, see group 11.

Needham silty clay loam (0 to 2 percent slopes) (NA).—This black, very poorly drained, deep, terrace soil occurs in glacial outwash valleys. It has developed chiefly from deposits of stratified calcareous silts and fine sands that contain some small limestone pebbles. The silty parent material, normally from 1 to 2 feet in thickness, usually is underlain by well-assorted calcareous gravel and sand. The nature and arrangement of the parent material and substratum are identical to those of the Mahalasville soil. This soil differs from the Mahalasville soil in being more poorly drained, in having thicker darker colored surface layers, and in having a finer textured and grayer subsoil. It is similar to Abington silty clay loam except that it is smoother throughout the profile and was derived from different parent material.

The soil occupies almost level, basinlike relief; consequently, surface runoff is very slow. Internal drainage also is very slow because the water table is high and the heavy subsoil and parent material are impermeable. Practically all of the soil is uneroded. This soil occurs principally in the upper valleys of the Little Miami River and its North and Lisbon Forks.

Mahalasville, Homer, and Mill Creek soils are the chief associated soils.

Profile description (cultivated area):

0 to 7 inches, black, friable to firm, smooth silty clay loam, coarse granular structure; neutral.
7 to 13 inches, black, smooth, heavy silty clay loam; breaks to coarse blocky pieces; firm when moist and slightly plastic when wet; neutral.
13 to 22 inches, smooth silty clay; very dark to almost black; coarse blocky structure; neutral.
22 to 40 inches, silty clay or clay; predominantly gray, mottled with yellowish brown; massive; very plastic and moderately sticky when wet; mildly alkaline.
40 inches +, stratified, calcareous silts and fine sands; gray or light brownish gray slightly mottled with yellowish brown; contains some small limestone pebbles; material ranges from 1 to 2 feet in thickness and abruptly overlies stratified calcareous gravel and sand.

The soil, as mapped, includes small patches that have a thin, very dark-gray silt loam surface soil. These areas represent a gradation toward the light-colored Homer soils. Other small patches have a thin silty muck surface layer. In places the parent material underlying the soil contains more pebbles than normal and somewhat resembles ordinary glacial till or poorly assorted glacial outwash gravel, sand, and silt.

Use suitability and management.—At the time of the survey, practically all of this soil had been cleared. About 90 percent was being used for crops and 10 percent for pasture. Most of the soil is drained by tile and ditches. The relatively impermeable parent material makes this soil more difficult to drain than the Westland or Abington soils.

Needham silty clay loam is abundantly supplied with organic matter and moderately well supplied with most plant nutrients. Its dark-colored surface layers are relatively high in nitrogen but are somewhat lower in phosphorus and potassium. It is nearly neutral in reaction. When the soil is drained, the dark-colored surface layers absorb moisture readily and are moderately well aerated and permeable to roots and water. The heavy subsoil, however, is much less permeable to water, air, and plant roots.

The soil receives large quantities of water and its heavy clayey subsoil holds much of it, sometimes an excessive amount. The soil is heavy and has a narrow range of moisture conditions under which it can be cultivated safely. If worked when too wet, it tends to run together, or puddle, and on drying it cracks and clods badly. Keeping it well supplied with raw organic matter is one of the best methods of maintaining favorable structure and improving tilth.

When drained, the soil is very well suited to corn, soybeans, most pasture and meadow grasses, and other plants that require much moisture. It is less well suited to small grains, alfalfa, and clovers. Small grains tend to lodge. Stands of winter small grains, alfalfa, and clovers are often reduced by heaving and winterkilling.

Continued high production of well-adapted crops and moderate production of less well adapted crops can be maintained by adequate fertilization, return of organic matter to the soil, and use of a 3- or 4-year rotation that includes 1 or 2 years of meadow. Pasture grasses do very well and produce better during dry summer months than those on the more droughty light-colored upland and terrace soils. For a further discussion of use and management, see group 4.

Randolph silt loam (0 to 2 percent slopes) (RA).—The soil has developed from shallow deposits of calcareous glacial drift that lie upon limestone bedrock. It is an imperfectly drained, moderately shallow, light-colored soil associated with the Milton and Millsdale soils. As for these soils, the depth to limestone ranges between 24 and 36 inches. The soil has a light-colored, smooth surface soil; a plastic, dense, relatively tough, mottled subsoil; and limestone directly below the subsoil.

The soil is almost level; only a few areas have undulating slopes of 2 to 5 percent. The soil typically occupies slightly more depressed relief than the Milton and more elevated relief than the Millsdale soils. Surface runoff is slow. Internal drainage is slow because there is no adequate outlet for subterranean drainage. Most of the soil is slightly sheet eroded.

This soil occurs in small to medium-sized areas. It is largely in the Milton-Randolph-Millsdale soil association, which is in the western half of the county. Areas are concentrated in the valleys of the Mad River west of Springfield and along Honey Creek east of New Carlisle.

Profile description (pastured area):

0 to 7 inches, grayish-brown to dark grayish-brown, very friable, relatively smooth, granular silt loam; slightly acid.
7 to 11 inches, yellowish-brown, friable, granular silt loam; slightly acid.
11 to 21 inches, dark yellowish-brown silty clay loam mottled with light grayish brown; well-developed medium blocky structure; firm to friable when moist and slightly plastic when wet; contains a few small, dark, iron concretions in lower part; medium acid.
21 to 26 inches, mottled dark-brown and light olive-brown clay loam; firm when moist and plastic when wet; coarse blocky structure; contains many small iron concretions; slightly acid.
26 to 33 inches, olive-brown clay mottled with dark grayish brown; plastic sticky, and tough when wet; massive structure; neutral.
33 inches +, limestone (dolomitic) bedrock.

The profile resembles that of Celina silt loam but differs in having lower subsoil layers that are finer textured and more mottled and plastic and in being underlain by limestone at depths of 24 to 36 inches. The upper and middle parts of the profile were derived from material weathered from glacial drift. The lower plastic part apparently has developed from materials residual from the weathering of limestone.

Northwest of Springfield and east of New Carlisle, the soil is in glacial valleys and appears to have been derived from thin deposits of glacial outwash gravel and sand over limestone. This variation resembles Bronson or Homer soils in the upper part of its profile but has the plastic, heavy lower subsoil and the shallow depth to limestone that are characteristic of the normal Randolph soil.

Locally, Randolph silt loam is poorly drained. These poorly drained areas have grayer surface soil and a subsoil more strongly mottled with gray than typical.

Use suitability and management.—At the time of the survey probably more than 85 percent of Randolph silt loam was used for crops or pasture.

The soil is medium acid in reaction, apparently low in organic matter, and fairly well supplied with plant nutrients. Its principal

unfavorable feature is its lack of adequate internal drainage, which is difficult to correct artificially because of the shallow depth to bedrock. The water table is high during the wet parts of the year. Tilth is favorable when the soil is sufficiently dry, but the soil dries out slowly in spring and frequently is too wet to plow for corn. If plowed when too wet, it tends to puddle and bake and become hard on drying. Owing to the nearly level relief, it is ordinarily only slightly subject to accelerated erosion.

The use suitability and management requirements of this soil are similar to those of Crosby silt loam, except that the Crosby is more easily drained artificially and probably has a slight advantage in productivity. For further discussion of use and management, see group 6.

Rodman gravelly loam, eroded steep phase (15 to 35 percent slopes (Rc).—This very shallow, steep, excessively drained, relatively dark colored gravelly soil has developed over calcareous stratified gravel and sand. It is chiefly on the steep terrace escarpments or valley walls along the glacial valley trains. The escarpments rise abruptly from the lower lying outwash valleys and merge into either higher terraces or uplands. Some of this soil, however, principally that in the northeastern part of the county, occurs on the gravelly moraines.

The higher, upper slopes of the soil are associated chiefly with the Fox or Bellefontaine soils, whereas the lower slopes typically adjoin Westland, Abington, or Carlisle soils. Most of this soil is in the Bellefontaine-Rodman soil association. The largest concentration of areas is in eastern Moorefield and western Pleasant Townships. The soil occurs in very elongated narrow areas and is not extensive.

Although this soil has steep slopes, it is extremely porous and therefore does not have surface runoff so high as for the deeper more clayey soils on comparable relief. The soil generally is uneroded to moderately sheet eroded, but a few areas are more severely sheet eroded. Gullies are not common.

Profile description (forested area):

0 to 4 inches, dark-brown to almost black when wet, loose gravelly loam; weakly developed fine crumb structure; pebbles are mostly less than 2 inches in diameter; relatively high in organic matter; mildly alkaline; ½- to 1-inch layer of forest litter and leaf mold on the surface.

4 to 20 inches +, yellowish-brown, loose, stratified, calcareous gravel and sand.

Although the soil has relatively uniform profile characteristics, it varies somewhat in depth. In some places a thin reddish-brown gravelly clay loam subsoil is present, and in others the surface soil is lighter brown than typical.

Use suitability and management.—At the time of the survey, probably not more than 65 percent of the soil had been cleared. All the cleared areas were in pasture, and many of the forested areas also were pastured.

Permeability of the soil to roots, moisture, and air is excellent, but its stoniness and low to very low water-holding capacity limit its usefulness for agriculture. Stones ordinarily interfere materially with cultivation, and the steep slopes practically prohibit use of most farm machinery. As a general rule, stoniness increases with depth.

The soil is thought to be low in content of most plant nutrients and low in capacity to hold added fertilizers.

Steep slopes, stoniness, low water-holding capacity, shallowness, and droughtiness make this soil unsuitable to the production of cultivated crops. It is best suited to permanent pasture or forest. Unless a great need for pasture exists, it is thought that the areas now forested should remain in forest. Good to fair stands of bluegrass and white clover pastures can be established and maintained. They are productive in spring and late in fall but tend to dry out and produce poorly during dry months late in summer and early in fall. Good pasture management should include adequate fertilization, particularly with phosphate, weed control, and carefully controlled grazing during dry weather. The steep relief handicaps weed control, as it hinders or prevents the use of mowing machines. For a further discussion of use and management, see group 12.

Rodman gravelly loam, eroded sloping and strongly sloping phases (10 to 15 percent slopes) (RB).—This soil has milder slopes but is otherwise similar to Rodman gravelly loam, eroded steep phase. It has developed over stratified calcareous gravel and sand. It occurs on glacial terrace escarpments or moraines. Included are small isolated patches that have a thin reddish-brown waxy clay loam subsoil.

Use suitability and management.—An estimated 70 to 80 percent of this soil was used for permanent pasture at the time of survey. Little, if any, was used for crops.

Because the soil has milder relief, it has slightly less runoff, greater water-supplying capacity, and better accessibility to farm machinery than the eroded steep phase. It is not suited to cultivated crops because it is droughty, but it is more productive of pasture than the eroded steep phase. Management requirements for the two are similar, but this strongly sloping soil permits easier use of mowing machines in controlling weeds. For a further discussion of use and management, see group 11.

Ross silty clay loam (0 to 2 percent slopes) (RE).—This very dark-brown, well-drained soil of the first bottoms consists of nearly neutral stream alluvium washed from uplands and terraces underlain by calcareous glacial drift of Late Wisconsin age. It is much like Genesee silt loam but darker colored, shallower, finer textured, and higher in organic-matter content. The soil is almost level, so runoff is very slow.

Internal drainage is medium because the sandy and gravelly substratum is highly porous. Like all first-bottom soils, this soil is ordinarily not subject to erosion; instead it frequently receives soil material carried by floodwaters.

Most of this soil is in the Sloan-Wabash-Genesee-Eel soil association. It lies along many of the streams of the county, but most extensively along the lower part of the Mad River. The moderately large elongated areas commonly are at slightly higher elevations and farther from the stream channels than areas of the associated Genesee, Eel, Shoals, Sloan, and Wabash soils. Thus, the soil is not so frequently overflowed.

Profile description (cultivated area):

0 to 11 inches, very dark-brown, almost black when wet, silty clay loam; moderately friable but somewhat compact; coarse granular structure; contains a few snail shells and pebbles; mildly alkaline.

11 to 26 inches, very dark-brown friable sandy loam; weak coarse granular structure; contains a few small pebbles; becomes lighter colored in lower 2 or 3 inches; mildly alkaline.
26 inches +, light yellowish-brown, loose, calcareous gravel and sand.

The profile varies mainly in color, texture, and thickness of horizons. Areas bordering Genesee soils are lighter in color and finer textured than normal. A few small areas are imperfectly drained and have a subsoil faintly mottled with light brownish gray. These usually adjoin and grade into the dark-colored poorly drained Sloan or Wabash soils.

Use suitability and management.—At the time of the survey practically all of this soil had been cleared and most of it used for cultivated crops, the use to which it is best suited. The soil is neutral or mildly alkaline and apparently has good supplies of organic matter and plant nutrients. Except when flooded, it absorbs water freely, allows moisture and roots to penetrate deeply and readily, and permits good circulation of air. It has good moisture-holding capacity and, in addition, lies where it receives a steady supply of water from higher land. The tilth is good over a wide range of moisture conditions, and the soil dries out early in spring. Because it is almost level, the soil is easily worked by all types of farm machinery.

This soil is more productive than Genesee silt loam and contains more organic matter. It needs about the same management as Genesee silt loam (see management group 1).

Ross silt loam (0 to 2 percent slopes) (Rd).—This soil has a very dark-brown, friable, silt loam surface soil and dark-brown, friable, fine sandy loam subsurface layer. It is a well-drained, fertile soil of the bottom lands. It differs from Ross silty clay loam primarily in having a coarser textured surface soil.

Included with Ross silt loam are small areas that have a loam surface soil. Also, in places, this soil is shallower than typical, or 20 inches or less in thickness over stratified calcareous gravel and sand.

Use suitability and management.—Almost all this soil was used for cultivated crops at the time of the survey. It is well suited to crops or pasture.

As for Ross silty clay loam, this soil requires management similar to that of Genesee silt loam. It is probably more productive than the Genesee soil because it contains more organic matter. Its suitability for crops is limited to some extent by its susceptibility to flooding. For further discussion of use and management, see group 1.

Shoals silt loam (0 to 2 percent slopes) (Sa).—This is an imperfectly drained, dark grayish-brown soil of the first bottoms. It developed from nearly neutral to calcareous stream alluvium that washed chiefly from uplands underlain by calcareous glacial drift of Late Wisconsin age. Although it occurs along several of the streams of the county, it is most extensive along the lower part of the Mad River south of Springfield, where it is associated with the Eel, Genesee, Ross, Sloan, and Wabash soils.

This soil is somewhat similar to the closely associated Eel silt loam except that it is more poorly drained, grayer, and more strongly mottled throughout the profile. It is almost level and generally at a slightly lower elevation than the Genesee, Eel, and Ross soils. Sur-

face runoff is very slow, and internal drainage is slow because of the high water table. The soil is not susceptible to erosion but is occasionally covered by thin layers of soil material deposited by floodwaters. The areas are moderately large and elongated, but this is not an extensive soil.

Profile description (pastured area):

0 to 7 inches, dark grayish-brown, friable, granular, heavy silt loam; moderately alkaline.
7 to 23 inches, dark-gray silty clay loam mottled with yellowish brown; friable when moist and slightly sticky when wet; coarse granular structure; moderately alkaline.
23 to 47 inches, mottled gray, yellowish-brown, and dark-gray silt loam; friable when moist; slightly plastic and sticky silty clay loam in upper 6 or 7 inches; contains a few small snail shells; moderately alkaline.
47 inches +, gray, calcareous gravel and sand; waterlogged; strongly alkaline.

The profile varies chiefly in depth to the underlying gravel, which ranges from 30 to more than 40 inches, and in reaction, which ranges from neutral to moderately alkaline. Minor variations in surface soil texture often occur within short distances.

Use suitability and management.—Probably about 60 to 70 percent of this soil was used for crops or pasture at the time of survey. Artificial drainage by ditching was attempted on some areas.

Although this soil is friable and underlain by loose gravel and sand, it has a high water table during wet parts of the year. When saturated with water, it has low permeability to roots and moisture and poor aeration. It is favored by good tilth, and except when wet it is easily accessible to farm machinery. The friable surface soil maintains favorable consistence and structure over a wide range of moisture conditions. Excessive soil moisture and lack of proper aeration are the chief unfavorable features. The water-supplying capacity is high to excessive. The moderately dark colored surface soil has relatively abundant organic matter, compared to the amount in lighter colored underlying material.

Unfavorable features restrict the use of this soil for cultivated crops, and it is best suited to permanent pasture. It produces a fair pasture but needs artificial drainage if nonweedy pastures of desirable grasses are to be grown. For further discussion of use and management see group 3.

Sloan silty clay loam (0 to 2 percent slopes) (Sc).—This deep, poorly drained, dark-colored bottom-land soil has developed from alkaline stream alluvium that washed chiefly from uplands underlain by calcareous glacial till. It closely resembles Wabash silty clay loam but does not have so dark or so thick a surface layer. The almost level relief causes very slow runoff. Internal drainage is very slow, primarily because the water table is normally high.

Accelerated erosion does not affect this soil, but in places floods occasionally deposit shallow layers of light-colored silty materials on the surface. The soil is closely associated with the Genesee, Eel, Ross, Shoals, Wabash, and Sloan silt loam soils along most of the principal streams of the county. Major concentrations of this soil are along Buck Creek, the Mad River, and the tributaries of the Little Miami River. Moderately large to large elongated areas of this soil are typical. Ordinarily, they occupy positions more depressed and far-

ther removed from the stream channel than the associated lighter colored soils.

Profile description (cultivated area):

0 to 19 inches, very dark-gray to black granular silty clay loam; firm to friable when moist; more compact and has weaker structure in lower 12 inches; mildly alkaline.

19 to 25 inches, very dark grayish-brown firm silty clay loam; mottled with yellowish brown; moderately developed medium nuciform structure; contains numerous small pebbles; neutral.

25 to 34 inches, mottled grayish-brown and olive-brown heavy silty clay loam; plastic and slightly sticky when wet and very firm when moist; weakly developed coarse blocky structure; contains numerous small pebbles; neutral.

34 to 39 inches, dark-gray silty clay mottled with olive brown; plastic and sticky when wet; massive structure; contains considerable amount of decomposed plant remains; neutral.

39 inches +, grayish-brown and light olive-brown weathered dirty gravel; contains streaks of dark-gray silty clay; gradual transition to clean, loose, calcareous gravel and sand; mildly alkaline.

Included with the soil are small areas, mostly along Buck Creek, where the soil is thinner than normal and is underlain by gravel and sand at depths of 24 inches or less. These areas, totaling less than 150 acres, would have been mapped as Sloan silty clay loam, shallow phase, had they occupied a larger total area. A few areas, usually at the base of slopes, have more undulating relief than is typical. Local patches along the Mad River have a lighter colored surface soil.

Use suitability and management.—Practically all of this soil has been cleared and is used for cultivated crops or pasture. It has good supplies of organic matter and plant nutrients and is neutral or slightly alkaline. The fluctuating water table, when high during winter and early in spring, restricts percolation of water and penetration and circulation of air. Artificial drainage is achieved largely through use of open ditches, but some areas are tiled. The water-holding capacity is high. The soil is heavy and difficult to work, especially when wet. Its favorable structure can be maintained by proper management. It is level and easily accessible to all types of farm machinery.

Use and management are similar to those for other dark-colored mineral soils of the county. This soil is well suited to corn, soybeans, and grasses. It is somewhat less well suited to small grains because of hazard of flooding and because grains tend to lodge on this soil. Alfalfa, clover, and winter small grains grown on this soil are damaged by heaving and winterkilling. Probably the principal undesirable feature of this soil is the flood hazard. For a further discussion of use and management, see group 3.

Sloan silt loam (0 to 2 percent slopes) (Sb).—This is a dark-colored, poorly drained, bottom-land soil. It differs from Sloan silty clay loam in having a slightly lighter colored coarser textured surface soil 6 to 10 inches thick. Otherwise, the two soils are essentially alike. The surface soil is a very dark-gray friable heavy silt loam; the subsoil is a mottled very dark grayish-brown plastic and sticky silty clay.

Use suitability and management.—Almost all of this soil was used for crops or pasture at the time of the survey. It is well suited to

the common crops when drained, but the flood hazard and susceptibility to heaving limit its usefulness for small grains. The use and management problems are similar to those for Sloan silty clay loam. This silt loam soil has a slight advantage because it has better tilth and workability. For a further discussion of use and management, see group 3.

Steep land-limestone outcrop (15 to 35+ percent slopes) (SD).—This steep land type has large outcrops of limestone bedrock and large, loose, fragments of limestone on the surface. Rocks occupy more than 60 percent of the land surface.

This land type occurs largely on the valley-wall escarpments of the Mad River southwest of Springfield. The soils between the stones and outcrops are principally shallow phases of Milton silt loam. Most of this land type is in the Milton-Randolph-Millsdale soil association, where it is associated principally with the Milton soils. Surface runoff and internal drainage are very rapid.

Use suitability and management.—Practically all of this land type is in forest. A few areas have been cleared for pasture, and some of the wooded areas are pastured.

Stones and steep slopes make cultivation almost impossible; the land is not suited to crops and is poor for pasture because it is shallow and droughty. The stones practically prohibit the use of mowing machines to suppress weeds. This land type probably is best used for forest or for quarrying. Southwest of Springfield in the gorge of the Mad River, many areas of this land type now have quarries. For a further discussion of use and management, see group 12.

Wabash silty clay loam (0 to 2 percent slopes) (WB).—This soil has darker and thicker surface layers but is otherwise much like Sloan silty clay loam. It is a black, very poorly drained bottom-land soil that developed from neutral or alkaline stream alluvium washed chiefly from soils underlain by calcareous glacial drift. It occupies almost level flood plains, principally those along the Mad River and Buck Creek. In many places adjacent to sloping areas of Fox soils, this soil has a high organic-matter content and dark color caused partly by the seepage and wash, highly charged with lime, that came from the Fox soils.

This soil is generally farther from the stream channel than the lighter colored bottom-land soils; consequently, it is less subject to stream overflow. Surface runoff is very slow. Internal drainage is very slow because the water table is normally high, and because the subsoil and substratum are impermeable.

This soil occurs in moderately large to large elongated areas along the major streams. It is closely associated with the Sloan, Carlisle, Algiers, Ross, Eel, and Genesee soils. Most of it is in the Sloan-Wabash-Genesee-Eel soil association. The soil is one of the most extensive bottom-land soils.

Profile description (pastured area):

0 to 2 inches, very dark-gray silty clay loam; black when wet; firm to friable; granular structure; neutral.
2 to 7 inches, black firm silty clay loam; breaks to granular aggregates; neutral.
7 to 14 inches, black, firm, heavy silty clay loam; plastic when wet; breaks to fine strongly defined granular pieces; neutral.

14 to 19 inches, black silty clay; very firm when moist and hard when dry; breaks to coarse granular pieces; mildly alkaline.
19 to 28 inches, black silty clay; very firm and compact when moist and plastic and sticky when wet; breaks in very coarse blocky pieces; mildly alkaline.
28 inches +, very dark-gray silty clay mottled with dark gray; very plastic and sticky; structureless; contains considerable amount of partly decomposed plant remains; becomes lighter gray with increasing depth; overlies gravel and sand at depths of 4 feet or more; mildly alkaline.

Some small areas that have a silt loam surface soil are included with this type. Most of these are at the base of slopes or along stream channels where they have recently received additions of soil material. Other areas, principally along Buck Creek, are shallower than normal, or 24 inches or less to a gravelly substratum.

Use suitability and management.—Practically all of this soil was used for pasture or crops when this survey was made. A larger percentage of this soil than of Sloan silty clay loam was used for pasture, primarily because it is more difficult to drain and because it is associated with the very wet Carlisle soils. Where this soil was cultivated, drainage was attempted through a system of tiles and open ditches.

Favorable soil reaction, a high content of organic matter and nitrogen, a high water-holding capacity, and fairly high content of plant nutrients are a few of the features that make this soil so valuable. If artificial drainage is provided, plant roots readily penetrate the dark surface layers, but root growth, percolation of water, and permeability to air are restricted in the denser subsurface horizons. This heavy soil is difficult to work, especially when wet, and tends to form hard clods on drying. It is not susceptible to erosion and, when it is not too wet, is easily accessible to all types of farm machinery.

If suitably drained, the soil is well suited to most cultivated crops and pasture. It is especially well suited to corn, grasses, and soybeans. Small grains are less suitable because of their tendency to lodge. Stands of clovers and winter small grains are sometimes reduced by heaving and winterkilling. Because the soil occupies low bottoms, it is sometimes overflowed. This is a hazard in growing some crops, especially the small grains. For further discussion of use and management, see group 3.

Wabash silt loam (0 to 2 percent slopes) (WA).—This dark-colored, very poorly drained soil of the bottom lands is much like Wabash silty clay loam, but has coarser textured, slightly lighter colored, 6- to 10-inch surface soil. These differences result from the lower organic-matter content, and from the larger amount of silty materials deposited by floodwaters and mixed with the original surface soil during tillage. The present surface soil is a very dark-gray, friable, heavy silt loam. The deeper layers are similar to the corresponding layers of Wabash silty clay loam.

Use suitability and management.—At the time of the survey this soil had been almost entirely cleared and was used for crops or pasture. Its use and management problems are similar to those for Wabash silty clay loam. It has, however, better qualities of tilth. For further discussion of use and management, see group 3.

Warners loam (0 to 5 percent slopes) (WC).—This inextensive, dark-colored, very poorly drained organic soil has developed over de-

posits of marl or travertine. Marl is the underlying material where this soil occurs in the low-lying bogs of the glacial outwash valleys, but travertine normally occurs on adjacent slopes. Beneath the marl or travertine is stratified gravel and sand. Typically, the soil occupies small moundlike rises in depressed basins surrounded or partly surrounded by Carlisle soils. Its distinguishing features are its alkaline reaction, the abundance of small lime fragments in the dark-colored organic surface layer, and the presence of marl or travertine at depths of 18 inches or less. The almost level to gently undulating relief results in low to medium surface runoff, and the normally high water table restricts internal drainage.

The soil occurs predominantly in small areas, mostly in the valleys of the Mad River and Buck Creek. It is associated with the Carlisle, Abington, Westland, and Wabash soils and is in the Carlisle-Warners soil association.

Profile description (pastured area):

0 to 9 inches, very dark-gray loam, almost black when wet; very friable; weak coarse granular structure; contains many small fragments of shells and lime; calcareous.
9 to 13 inches, very dark-gray, finely divided, massive, friable, silty muck; contains many shells and lime fragments; calcareous.
13 inches +, light-gray, soft, gritty marl; contains scattered snail shells and decomposed plant remains; calcareous.

Where this soil is under cultivation, its surface horizon is lighter colored and contains more lime fragments. These fragments were incorporated during cultivation. In many cultivated areas, the marl or travertine is at plow depth.

Use suitability and management.—At the time of the survey most of this soil had been cleared. Probably 65 percent of it was in pasture, and the remaining 30 to 35 percent was cultivated. This soil is alkaline. It has fairly large supplies of organic matter and nitrogen but is low in other plant nutrients.

Artificial drainage is necessary for the satisfactory production of most crops, but the soil is more easily drained than the lower lying and wetter Carlisle soils. Tilth is very good over a wide range of moisture conditions, and the soil is rarely under water for a long period. Artificial drainage greatly increases the permeability of the soil to roots, moisture, and air. The water-holding capacity is only medium, mainly because of the limited amount of clay in the soil profile. When drained, the soil is accessible to most farm machinery.

This soil is probably best suited to permanent pasture. It commonly occurs in areas too small to handle individually and is usually surrounded by or closely associated with the Carlisle soils, which are poorly suited to cultivation unless thoroughly drained. Most of the areas now cultivated are closely associated with areas of Westland or Abington soils and are used and managed in the same manner.

Lime is not needed, but this soil needs liberal applications of phosphate and potash, and possibly some nitrogen. For a further discussion of use and management, see group 9.

Warsaw silt loam, nearly level phase (0 to 2 percent slopes) (We).—This well-drained, deep soil of the glacial outwash valleys differs from Fox silt loam, nearly level phase, in having a considerably darker and thicker surface soil layer. It has developed over well-

assorted calcareous gravel and sand and is distinguished chiefly by its very dark-brown surface soil and brown or reddish-brown waxy subsoil. "Dark chocolate land" is a local name commonly given to this soil, but the farmers recognize that it differs from the other dark-colored soils, which normally are very poorly drained.

Accelerated erosion is only slight. The almost level relief results in slow surface runoff. Internal drainage is medium because the parent material is readily permeable gravel and sand.

The soil occurs in relatively large areas that are very closely associated with the Fox soils and to some extent with the Westland and Abington soils. This soil occurs mainly in the Fox-Homer-Warsaw soil association. The major concentrations of this soil are in the Pretty Prairie region north of Springfield and in a belt crossing United States Highway No. 40 east of Springfield.

Profile description (cultivated area):

0 to 15 inches, very dark-brown to almost black silt loam; smooth; very friable; crumbles into granular pieces; relatively high in organic matter; slightly acid.
15 to 20 inches, dark-brown friable heavy silt loam; coarse granular structure; moderately high in organic matter; medium acid.
20 to 26 inches, brown firm silty clay loam; breaks into nutlike pieces; medium acid.
26 to 43 inches, brown to reddish-brown clay loam; plastic and slightly sticky when wet; contains a few pebbles; medium acid.
43 to 51 inches, dark-brown gravelly clay loam; friable when moist but moderately plastic and sticky when wet; slightly acid.
51 inches +, clean, loose, stratified, calcareous, coarse sand and gravel.

The soil varies considerably in depth; a few areas are less than 2 feet deep to the gravel-and-sand substratum. In such places, the soil profile contains more gravel and the soil layers are thinner than normal. A few scattered areas are less well drained and have a yellowish-brown subsoil slightly mottled with brownish gray.

Use suitability and management.—At the time of the survey all of this soil had been cleared and probably 90 percent of it was being used for cultivated crops. Many farmers consider this to be the best general-purpose soil in the county. It is relatively rich in organic matter, has a favorable reaction, and is apparently well supplied with most plant nutrients, particularly nitrogen. Water freely penetrates the entire soil mass, and, although it is removed rather rapidly through the porous substratum, enough is retained by the clayey subsoil to allow good growth of most crops. Plant roots penetrate readily, and air circulates freely. Tilth is excellent over a wide range of moisture conditions and is easily maintained under good management. The soil is nearly level and therefore not susceptible to erosion and easily accessible to all farm machinery.

This Warsaw soil is very well suited to production of almost all the common crops. It is not so well suited to corn or soybeans as the very poorly drained dark-colored soils, but probably is the best soil in the county for small grains, clovers, alfalfa, and many grasses. It responds to good management and retains the effects of such management. If well managed, it will produce steadily for a long period of years. For further discussion of use and management, see group 2.

Warsaw silt loam, gently undulating phase (2 to 5 percent slopes) (WD).—This well-drained, dark-colored soil of the glacial outwash terraces has developed over stratified calcareous gravel and sand. It

is similar to Warsaw silt loam, nearly level phase, but it occupies stronger relief and has some gravel throughout its profile. Accelerated erosion ranges from slight to moderate, but more than 80 percent of the soil is only slightly sheet eroded. In practically all places, however, the plow layer is composed of very dark-brown, very friable silt loam, the material that formed the original surface soil.

Use suitability and management.—At the time of survey all, or almost all, of this soil was used for crops, the use to which it is best suited.

Largely because of its stronger relief, this soil has a more rapid surface runoff and a lower water-supplying capacity than the nearly level phase. Also, it is more erodible and, on the average, slightly less productive. The management requirements for the two soils are similar. For further discussion of use and management, see group 5.

Wawaka silt loam (0 to 2 percent slopes) (WF).—This well-drained, moderately deep, light-colored, upland soil was derived from calcareous glacial till. It is much like Miami silt loam, undulating phase, except that it has smoother relief. It also differs in having gravel and sand at depths of 35 inches or more. This porous sand and gravel, which is below the glacial till, assured good underdrainage during the development of the soil. Surface runoff is slow, but internal drainage is medium. The soil is practically uneroded to slightly sheet eroded. This Wawaka soil occupies relatively large areas and is in the Miami-Kendallville-Celina-Crosby soil association. The Miami and Celina are the chief associated soils.

Profile description (cultivated area):

0 to 8 inches, grayish or yellowish-brown very friable granular silt loam; slightly acid.
8 to 12 inches, brown friable granular silt loam; slightly acid.
12 to 27 inches, brown firm clay loam; breaks into nutlike pieces; contains a few pebbles in lower part; slightly acid.
27 to 35 inches, dark-brown very firm gritty clay loam; plastic when wet; slightly acid.
35 to 62 inches, yellowish-brown compact calcareous glacial till.
62 inches +, stratified, calcareous, loose gravel and sand.

The soil varies but slightly in surface soil and subsoil characteristics. The main variation is in the depth to gravel or sand, which may be a depth anywhere between 35 inches and 12 feet.

Use suitability and management.—At the time of the survey, practically all of this soil had been cleared and most of it was being used as cropland. It is slightly to moderately acid in reaction and relatively low in organic-matter content, but apparently moderately well supplied with most plant nutrients. Although water moves fairly rapidly through the soil, the relatively thick and moderately fine textured subsoil holds water well and supplies sufficient moisture for plant growth in most seasons. The soil is permeable to plant roots, moisture, and air and maintains its good tilth over a fairly wide range of moisture conditions. Higher capacity to absorb and supply water and less susceptibility to erosion make it a more desirable soil than Miami silt loam, undulating phase.

The soil is well suited to the production of the common crops, including alfalfa, and has about the same problems of management as Fox silt loam, nearly level phase. It is especially well suited to small grains and deep-rooted clovers. It responds to good management and retains the effects of such management. For further discussion of use and management, see group 2.

Westland silty clay loam (0 to 2 percent slopes) (WH).—This dark-colored, very poorly drained, deep, terrace soil has developed over stratified calcareous gravel and sand of the glacial outwash valleys. It closely resembles Abington silty clay loam but differs mainly in having a thinner and less dark surface layer.

This soil occupies almost level areas on broad, slightly depressed flats in the glacial valleys. In these valleys the closely associated Abington soils occur in the deeper depressions, and the lighter colored associated Fox, Mill Creek, Bronson, and Homer soils occupy the higher levels. The soils are in the Westland-Abington soil association.

Since the relief is so smooth, surface runoff is very slow. Despite the porous gravel- and sand-substratum, this soil is very slowly drained internally, because the water table is normally high. Practically all of this soil, however, is now artificially drained. Although the soil occupies relatively large areas in practically all of the glacial valleys, most of it is in the valleys of the Mad and Little Miami Rivers and Buck Creek.

Profile description (cultivated area):

0 to 7 inches, very dark-gray or very dark-brown friable to firm silty clay loam; weak coarse granular structure; neutral to slightly acid.
7 to 15 inches, very dark-gray or black silty clay loam; moderate fine subangular blocky structure; firm when moist; neutral.
15 to 24 inches, mottled grayish-brown, very dark gray, and yellowish-brown silty clay loam to silty clay; moderate coarse angular blocky structure; firm to very firm when moist, plastic when wet; neutral.
24 to 44 inches, mottled yellowish-brown, gray, and very dark brown gravelly clay loam; weak to moderate coarse and very coarse angular blocky structure; firm to very firm when moist; gravel content increases with depth; neutral to mildly alkaline.
44 inches +, stratified gravel and sand; loose; calcareous.

The depth to calcareous gravel and sand is more than 40 inches in most areas. In some included areas, however, the depth to gravel and sand ranges between 32 and 40 inches. An important variation occurs east of New Carlisle in the Honey Creek valley. In this area the gravel substratum is thin and is underlain by glacial till at depths of 30 to 60 inches. Some small scattered areas have stronger relief. These are usually at the base of slopes and are covered with thin coatings of light-colored silty materials that washed from adjoining eroded slopes.

Use suitability and management.—At the time of the survey, practically all of this soil was cultivated; only a small part was used for pasture. The soil is well supplied with organic matter and, compared to the light-colored soils, has fairly good supplies of nitrogen and most other plant nutrients. Its reaction is near neutral. Artificial drainage greatly improves permeability of the soil to moisture, air, and plant roots. The soil absorbs and holds water well. Tilth is rather poor, but the soil is not susceptible to erosion and is accessible to heavy farm machinery when not too wet.

When drained, this soil is well suited to all the common crops, particularly corn, soybeans, and other crops that require much moisture. Small grains, however, are subject to lodging, and clovers and winter small grains are damaged by heaving and winterkilling on this heavy soil. Productivity is easily conserved in a short rotation. For further discussion of use and management, see group 4.

Westland silt loam (0 to 2 percent slopes) (Wg).—This soil is similar to Westland silty clay loam in general appearance; it differs mainly in having a coarser textured 6- to 10-inch surface soil. The surface soil contains sufficient silt and clay to have good water-holding properties, but if it is tilled while wet, hard clods do not form so readily as on the silty clay loam. A considerable part of the soil lies at the base of eroded slopes where it has received light-colored silty soil material. This material has gradually been mixed with the original surface soil through tillage. The soil is largely uneroded.

Use suitability and management.—This soil was almost entirely used for crops at the time of the survey; minor acreages were in pasture. This soil needs use and management similar to those of Westland silty clay loam. Yields are similar for the two soils. For a further discussion of use and management, see group 4.

USE AND MANAGEMENT OF SOILS

The soils of Clark County have been placed in 12 management groups, according to their use suitability and management requirements. All of the soils in a given group need about the same management, but it does not follow that results will be the same for every soil, because some soils respond to management more readily than others. Suitability for pasture and for woodland, as well as for cropland, was considered in making the management groupings.

Management practices suitable for each of the 12 management groups are discussed in the following pages and are summarized in table 4. The suggested practices should be adjusted according to the type, size, and field arrangement of each farm. Fertilizer and lime requirements for crops on specific fields should be determined by soil tests. Farmers can consult the county agent or local representative of the Soil Conservation Service, or write to the Ohio Agricultural Experiment Station or the Ohio State University for help with individual management problems, and for help in making soil tests.

MANAGEMENT GROUP 1

Group 1 is made up of well drained and moderately well drained, brown to dark-brown, nearly level soils of the bottom lands. These are the most fertile soils of the county and are well suited to intensive cultivation or to pasturing. This group covers about 2.6 percent of the total area of the county. It is made up of the following soils:

Eel silt loam.
Genesee loam.
Genesee silt loam.
Ross silt loam.
Ross silty clay loam.

All of these soils are well drained, except the Eel soil, which is moderately well drained. Compared to other soils of the county, they are well supplied with the necessary plant nutrients, lime, and organic matter. These materials are replenished periodically by additions of fresh sediments. Good yields of suitable crops are normal in favorable seasons, and without fertilization. Moisture supplies usually are adequate. In most places, intertilled crops have been successfully grown year after year, without soil treatments. A short rotation will maintain productivity.

TABLE 4.—*Use suitability and management requirements of the soils*

Management group and soil	Map symbol	Slope	Suitable crops or use	Cropping system
		Percent		
Group 1:			*Crops well suited to areas seldom or never flooded:* Corn, soybeans, white-clover, alsike clover, red clover, wheat, barley, alfalfa, and truck crops.[5] *Crops well suited to areas flooded:* Corn, soybeans, Ladino clover, alsike clover, and vegetables. *Areas frequently flooded:* Permanent pasture.	*Areas seldom or never flooded:* Row crop for 1 or 2 years, a small grain,[2] and legume-grass mixture for 1 to 2 years.[3] *Areas occasionally flooded:* Row crop followed by sweetclover and ryegrass.[4] Row crop for 1 to 3 years, oats, and legume-grass mixture for 1 to 2 years.
Eel silt loam	EA	0–2		
Genesee loam	GA	0–2		
Genesee silt loam	GB	0–2		
Ross silt loam	RD	0–2		
Ross silty clay loam	RE	0–2		
Group 2:			*Crops well suited:* Alfalfa, sweetclover, orchard-grass, bromegrass, red clover, Ladino clover, whiteclover, and pasture grasses. *Crops moderately well suited:* Corn, small grains, and soybeans.	*All areas:* Row crop, a small grain, and legume-grass mixture. Corn, soybeans, a small grain, and legume-grass mixture for 2 years.
Bronson silt loam	BL	0–2		
Fox fine sandy loam, nearly level phase	FB	0–2		
Fox loam, nearly level phase	FK	0–2		
Fox silt loam:				
Nearly level phase	FT	0–2		
Nearly level deep phase	FS	0–2		
Nearly level shallow phase	FU	0–2		
Miami silt loam, nearly level phase	MH	0–2		
Mill Creek silt loam, nearly level phase	MO	0–2		
Milton silt loam, nearly level phase	MX	0–2		
Warsaw silt loam, nearly level phase	WE	0–2		
Wawaka silt loam	WF	0–2		
Group 3:			*Crops well suited to areas seldom or never flooded:* Corn, soybeans, alfalfa, red clover, Ladino clover, wheat, and barley. *Crops well suited to areas flooded:* Corn, soybeans, Ladino clover, and alsike clover. *Areas frequently flooded:* Pasture.	*Areas seldom or never flooded:* Row crop for 1 to 3 years, a small grain, and sweetclover or legume grass mixture for 1 or 2 years. *Areas occasionally flooded or in backwater positions:* Row crop followed by sweetclover and ryegrass. Row crop for 1 to 3 years, oats, and legume-grass mixture for 1 to 2 years.
Algiers silt loam	AB	0–2		
Shoals silt loam	SA	0–2		
Sloan silt loam	SB	0–2		
Sloan silty clay loam	SC	0–2		
Wabash silt loam	WA	0–2		
Wabash silty clay loam	WB	0–2		

Group 4:				
Abington silty clay loam	AA	0–2	*Crops well suited to areas artificially drained:* Corn, soybeans, pasture grasses, and alsike, white, and Ladino clovers. *Crops moderately well suited to areas artificially drained:* Red clover, alfalfa wheat barley, and oats. *Crops suited to areas not drained:* Sod crops for pasture.	*Areas artificially drained:* Row crop for 1 to 2 years, small grain, and sweetclover or legume-grass mixture for 1 or 2 years.
Brookston silt loam	BM	0–2		
Brookston silty clay loam	BN	0–2		
Kokomo silty clay loam	KF	0–2		
Mahalasville silty clay loam	MA	0–2		
Millsdale silty clay loam	MP	0–2		
Needham silty clay loam	NA	0–2		
Westland silt loam	WG	0–2		
Westland silty clay loam	WH	0–2		
Group 5:				
Bellefontaine silt loam, undulating phase	BK	2–5	*Crops well suited:* Alfalfa, sweetclover, orchardgrass, bromegrass, red clover, Ladino clover, and whiteclover. *Crops moderately well suited:* Corn and soybeans.	Row crop, small grain, and legume-grass mixture for 1 to 3 years.
Celina silt loam, undulating phase	CE	2–5		
Fox fine sandy loam, gently undulating phase.	FA	2–5		
Fox loam, gently undulating phase	FH	2–5		
Fox silt loam:				
Gently undulating phase	FP	2–5		
Gently undulating deep phase	FO	2–5		
Gently undulating shallow phase	FR	2–5		
Kendallville silt loam, undulating phase	KE	2–5		
Miami silt loam, undulating phase	MM	2–5		
Mill Creek silt loam, gently undulating phase.	MN	2–5		
Milton silt loam, gently sloping phase	MV	2–5		
Warsaw silt loam, gently undulating phase.	WD	2–5		
Group 6:				
Celina-Crosby silt loams, nearly level phases.	CG	0–2	*Crops moderately well suited:* Corn, soy beans, small grains, red clover, Ladino clover, and alsike clover. *Crops fairly well suited to poorly suited:* Alfalfa.	Row crop, small grain, and legume-grass mixture for 2 years (1 year of legume-grass mixture if row crop is soybeans).
Crosby silt loam:				
Gently undulating phase	CH	2–5		
Nearly level phase	CK	0–2		
Homer silt loam	HA	0–2		
Randolph silt loam	RA	0–2		

[1] Consult the county agent for information on soil testing and for advice on fertilizing and liming.

[2] Small grain may be oats, wheat, barley, or rye.

[3] Legume-grass mixture may be used for hay or pasture. Alfalfa, red clover, alsike clover, timothy, and smooth bromegrass make up a suitable hay mixture. Ladino clover and orchardgrass are best suited to pasture only

[4] If row crops are grown conti
at the last cultivation.

[5] Adapted truck crops includ
kale, cauliflower, carrots, beets,

TABLE 4.—*Use suitability and management requirements of the soils of Cl*

Management group and soil	Map symbol	Slope	Suitable crops or use	Cropping system
		Percent		
Group 7:			*Crops well suited:* Alfalfa, orchardgrass, Ladino clover, timothy, wheat, and barley. *Crops moderately well suited:* Corn, soybeans, and oats.	*With water and erosion control:* Row crop, wheat or other small grain, and legume-grass mixture for 2 or 3 years. (4- to 5-year rotation that includes 2 or 3 years of legume-grass meadow generally satisfactory.) *Without water and erosion control:* Small grain followed by legume-grass mixture for 2 to 3 years.
Bellefontaine silt loam, eroded undulating phase.	BF	2–5		
Celina silt loam, eroded undulating phase.	CD	2–5		
Fox gravelly loam, eroded gently undulating phase.	FC	2–5		
Fox silt loam, eroded gently undulating phase.	FL	2–5		
Kendallville silt loam, eroded undulating phase.	KB	2–5		
Miami silt loam, eroded undulating phase.	ME	2–5		
Milton silt loam, eroded gently sloping phase.	MR	2–5		
Group 8:			*Crops well suited:* Alfalfa, orchardgrass, red cover, Ladino clover, and timothy. *Crops moderately well suited:* Corn, soybeans, and oats.	*With special measures to control erosion:* Row crop, wheat or other small grain, and legume-grass mixture for 3 years. *For areas without special measures to control erosion:* Small grain, followed by legume-grass mixture for 3 years.
Bellefontaine silt loam:				
Gently rolling phase	BG	5–10		
Eroded gently rolling phase	BE	5–10		
Fox silt loam, eroded sloping phase	FM	5–10		
Kendallville silt loam:				
Gently rolling phase	KC	5–10		
Eroded gently rolling phase	KA	5–10		
Miami silt loam:				
Gently rolling phase	MF	5–10		
Eroded gently rolling phase	MB	5–10		
Milton silt loam, eroded sloping phase	MS	5–10		
Group 9:			*Crops well suited to areas with deep layer of muck and optimum drainage:* Truck crops,[5] corn, soybeans, and possibly red clover. *Crops well suited to areas wet most of time:* Pasture grasses.	*Drained areas:* Vegetable crop, corn or soybeans, and rye cover crop for green manure. *Undrained areas:* Pasture.
Carlisle muck	CA	0–2		
Carlisle muck, shallow phase	CB	0–2		
Carlisle silty muck, shallow phase	CC	0–2		
Warners loam	WC	0–5		

Group 10:				
Bellefontaine silt loam, severely eroded gently rolling phase.	BH	5–10	*Crops well suited:* Permanent pasture grasses and legumes—bluegrass, Ladino clover, white-clover, smooth brome-grass, and alfalfa. *Crops moderately well suited:* Wheat, barley, rye, and red clover. *Crops poorly suited:* Corn and other row crops.	*Areas associated with soils more suitable for crops:* Wheat or oats, and legume-grass mixture for 2 years or more. *Areas consisting principally of soils of this group:* Corn, wheat or oats, and legume-grass mixture for 7 to 10 years. Permanent pasture.
Fox silt loam:				
Eroded sloping shallow phase	FN	5–10		
Severely eroded gently undulating phase.	FV	2–5		
Severely eroded sloping phase	FW	5–10		
Fox gravelly loam:				
Severely eroded sloping phase	FG	5–10		
Eroded sloping phase	FE	5–10		
Kendallville silt loam, severely eroded gently rolling phase.	KD	5–10		
Miami silt loam, severely eroded gently rolling phase.	MK	5–10		
Milton silt loam, severely eroded sloping phase.	MY	5–10		
Group 11:				
Bellefontaine loam and silt loam:				
Rolling phases	BC	10–15	*Crops well suited:* Pasture grasses and plants such as bluegrass, Ladino clover, smooth brome-grass, and alfalfa.	*Cleared:* Permanent pasture. *Forested:* Keep in forest.
Eroded rolling phases	BB	10–15		
Severely eroded rolling phases	BD	10–15		
Eroded hilly phases	BA	15–35		
Fox gravelly loam:				
Eroded strongly sloping phase	FF	10–15		
Moderately steep phase	FD	15–35		
Miami silt loam:				
Eroded rolling phase	MD	10–15		
Severely eroded rolling phase	ML	10–15		
Hilly phase	MG	15–35		
Eroded hilly phase	MC	15–35		
Milton silt loam:				
Gently sloping shallow phase	MW	2–5		
Eroded sloping shallow phase	MT	5–10		
Eroded strongly sloping shallow phase	MU	10–35		
Rodman gravelly loam, eroded sloping and strongly sloping phases.	RB	10–15		
Group 12:[6]			Best suited to use as woodland; cleared areas may be used for permanent pasture if it is needed.	*Cleared:* Permanent pasture if needed. *Forested:* Keep in forest.
Rodman gravelly loam, eroded steep phase.	RC	15–35		
Steep land-limestone outcrop	SD	15–35+		

[1] Consult the county agent for information on soil testing and for advice on fertilizing and liming.

[5] Adapted truck crops includ
kale, cauliflower, carrots, beets,
[6] Made land (M), shown on so

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The soils are deep, friable, and readily permeable to moisture, air, and roots, at least to the depth roots ordinarily go. They are practically free of stones and gravel but locally have scattered overlying deposits of sandy or gravelly materials. Because these soils are on nearly level first bottoms, surface runoff is slow and there is practically no problem of erosion or water loss. Some areas, however, are subject to flooding, especially in winter and spring. These soils are easily worked over a wide range of moisture conditions, and heavy farm machinery can be used.

Use suitability and management requirements.—Although the soils of group 1 are fertile and adapted to intensive cultivation, there are some limitations on their use. In many cases, they occur in small, elongated bodies, which are so intricately associated with other soil areas that use and management as individual units is not practical. They are subject to flooding from stream overflow; consequently, they are not suitable for winter small grains or alfalfa, which are easily drowned out. Red, Ladino, and alsike clovers are better suited, and corn, soybeans, most vegetables, and most grasses are well suited.

Small grains planted on these bottom-land soils tend to lodge and to mature later than on well-drained upland or terrace soils. Lodging can be partly avoided by planting stiff-strawed varieties, and by using fertilizers high in phosphorus and potassium.

Although tilled crops have been grown almost continuously on these soils, without benefit of cover crops, a short rotation is advisable to control weeds and to supply organic matter. The choice of a rotation depends on the frequency and duration of floods. Suitable rotations are given in table 4.

Moderate amounts of commercial fertilizer, especially one high in phosphorus and potassium and somewhat lower in nitrogen, may be used to advantage on corn and small grains. Little or no lime is needed. Crop residues should be returned to the soil.

Group 1 soils are very well suited for pasture and are used extensively for this purpose, especially in areas where floods are frequent. Because they have a good supply of moisture, these pastures are among the most productive in the county. Generally, they need neither lime nor fertilizer, but they should be mowed regularly and grazing should be controlled.

MANAGEMENT GROUP 2

Group 2 is made up of nearly level, well-drained, light-colored, deep or moderately deep soils of the terraces and uplands. The soils are very good to excellent for either crops or pasture and are among the best agricultural soils in the county. All except the moderately well drained Bronson silt loam are well to somewhat excessively drained. All except the Warsaw silt loam, nearly level phase, have light-colored surface soils that are moderately low in organic-matter content. Relief is level or nearly level; consequently, surface runoff is slow and accelerated erosion is slight. Internal drainage is medium to rapid, depending largely on the permeability of the underlying parent material. This group, which covers about 9 percent of the county, contains the following soils:

Bronson silt loam.
Fox fine sandy loam, nearly level phase.
Fox loam, nearly level phase.
Fox silt loam, nearly level phase.
Fox silt loam, nearly level deep phase.
Fox silt loam, nearly level shallow phase.
Miami silt loam, nearly level phase.
Mill Creek silt loam, nearly level phase.
Milton silt loam, nearly level phase.
Warsaw silt loam, nearly level phase.
Wawaka silt loam.

These soils are very easy to work and to conserve and have good to fair water-supplying capacity. The Fox soils may supply insufficient moisture for corn, in case of an extended drought. Except for the Bronson soil, group 2 soils are very easily permeable to moisture, air, and plant roots. The relief favors operation of farm machinery, and the soils dry out rapidly and are in condition to be cultivated shortly after rainy periods. Although only moderately fertile and acid in reaction, the soils of this group are responsive to good management and their productivity is easily maintained.

Use suitability and management requirements.—Soils of group 2 are very well suited to a wide variety of crops, including all the small grains and grasses, as well as red clover, Ladino clover, alfalfa, and potatoes. They are only moderately well suited to corn, soybeans, and other crops that are sensitive to drought.

A 3-year rotation will maintain the productivity of these soils, if alfalfa or a similar legume is grown as the hay crop. A rotation consisting of 1 year of corn or soybeans, followed by a small grain, and then 2 years of legume-grass meadow is probably the best for these soils. An alternative rotation of corn, soybeans, a small grain, and 2 years of legume-grass meadow might be used; this rotation will not maintain complete balance of fertility, but the deficiency can be made up by planting winter cover crops. The meadow mixture should include red clover, alfalfa, timothy, and possibly some alsike clover and orchardgrass.

Fertilizer requirements.—All the soils of group 2 need lime periodically, but not in large amounts. Phosphorus, potassium, and nitrogen are generally needed for satisfactory crop growth; commercial fertilizer containing the necessary amount of these elements should be used. Part of the nitrogen requirement can be supplied by growing legumes in the hay crop. All plant residues should be plowed under, and barnyard manure should be applied to supply organic matter and improve tilth and water-holding capacity. Part of the manure should be used as topdressing on winter wheat, and part should be applied before fields are plowed for intertilled crops.

These soils can be tilled over a wide range of moisture conditions and are easily maintained in good to excellent tilth. Erosion control is not a problem, but conservation of soil moisture is important.

Soils of this group are also well suited to pasture. Lime and phosphorus are needed for high yields. Regulated grazing and regular mowing are needed to control weeds and to maintain quality and productivity.

MANAGEMENT GROUP 3

Group 3 is made up of nearly level, imperfectly drained, poorly drained, or very poorly drained soils of the bottom lands. This group

covers about 4.6 percent of the county area, and contains the following soils:

Algiers silt loam.
Shoals silt loam.
Sloan silt loam.
Sloan silty clay loam.
Wabash silt loam.
Wabash silty clay loam.

These soils are dark colored and very poorly drained, except for the Algiers soil, which has a moderately thin light-colored surface soil overlying dark-colored, finer textured subsoil layers. Relief is nearly level. Surface runoff is slow to very slow, and there is no problem of accelerated erosion. These are very fertile soils but their suitability is limited by frequent flooding and slow internal drainage. If drained, they are among the most productive soils of the county. Tiling and ditching have improved the drainage in many places. Further improvements could be made by extension of tiling systems.

Except for the Algiers soil, group 3 soils are fine textured below the surface layer and difficult to work, especially when wet. The moisture range within which they can be tilled without clodding is narrow. The relief is favorable for use of farm machinery, but the soils are likely to be too wet in spring to accommodate heavy equipment.

The soils are neutral or nearly neutral in reaction and do not require lime. Natural fertility is high; however, the soils are probably lower in plant nutrients, except nitrogen, than the soils of group 1.

Use suitability and management requirements.—These soils are well suited to most pasture grasses. If adequately drained, they are exceptionally well suited to corn, soybeans, and meadow grasses. Where the land is subject to periodic flooding, red clover, alfalfa, and other deep-rooted legumes, especially biennials and perennials, are not suitable, but alsike clover, Ladino clover, white clover, and other shallow-rooted legumes can be grown. Winter-sown small grains are not very well suited to areas subject to frequent flooding because of the likelihood of damage to the crop during winter and early in spring. Heaving, caused by alternate freezing and thawing, often damages small grains and some legumes, especially on soils that have silty clay loam surface textures.

Some crops can be successfully grown year after year on these soils, but crop rotation is advisable to help maintain productivity and control weeds. Where floods cannot be prevented, the rotation should consist of annual spring-seeded crops, probably corn or soybeans, small grains, and grass-legume mixtures that will not be seriously injured by ordinary floods. Early varieties of soybeans, or Sudangrass for either hay or seed, may be useful if seeding is delayed because of floods.

The structure of these soils may be damaged if intertilled crops are grown continuously. If the soil is tilled when it is too wet, it will puddle. Puddled soils can be improved by plowing under crop residues to add raw organic matter, by applying barnyard manure, or by turning under green-manure crops. Fertility and tilth are also improved by the added organic matter. Leaving a stand of grasses and legumes on the soil for a period between tilled crops also helps improve soil structure.

Cultivation of group 3 soils is difficult, because, even when drained, they are likely to be flooded or too wet for plowing early in spring.

When drained and well managed, the soils of this group are excellent for pasture. Pasture grasses and alsike and Ladino clovers are well-adapted. Pasture management suggestions given for group 2 soils are applicable to this group.

MANAGEMENT GROUP 4

Group 4 is made up of very poorly drained, dark-colored, deep soils of the terraces and uplands. If adequately drained, the soils are very good to excellent for either crops or pasture; they are very easy to conserve and are highly productive when well managed. Relief is nearly level; consequently, surface runoff is very slow and erosion is slight. Internal drainage, however, is very slow, principally because of a high water table. Group 4 covers about 22.6 percent of the county and contains the following soils:

Abington silty clay loam.
Brookston silt loam.
Brookston silty clay loam.
Kokomo silty clay loam.
Mahalasville silty clay loam.
Millsdale silty clay loam.
Needham silty clay loam.
Westland silt loam.
Westland silty clay loam.

By artificial drainage the water table can be lowered enough to permit moderately good aeration and permeability to depths sufficient for normal root development. Natural fertility is high. The soils are neutral or only very slightly acid. If drained, they have fairly high capacity to absorb, retain, and supply moisture.

Soils of this group, especially those with silty clay loam surface layers, are heavy and difficult to work, particularly when wet. They can be tilled without clodding or puddling only within a narrow range of moisture content. The smooth relief is favorable for the use of heavy farm machinery, but the soils are often too wet in spring to accommodate such equipment.

Use suitability and management requirements.—When adequately drained, group 4 soils are especially well suited to corn. Other well-adapted crops are soybeans, alsike clover, white clover, Ladino clover, and practically all adapted grasses. Red clover, alfalfa, and most small grains are only moderately well suited. Small grains tend to lodge because the soils contain much organic matter and nitrogen. Because they are fine textured, the soils are likely to heave; consequently, red clover, alfalfa, and winter grains may be damaged.

A flexible 3- to 5-year rotation well suited to these soils consists of 1 or 2 years of corn or soybeans, followed by wheat or oats, and then sweetclover or a legume-grass mixture for 1 or 2 years. If corn or soybeans are planted in successive years, an intercrop should be seeded for green manure. Rye is normally the most satisfactory crop for this purpose, but ryegrass and sweetclover, seeded at the last cultivation of the corn, are more beneficial to the soil, if good stands can be obtained. Alfalfa grows moderately well on these soils if they are drained. It may be seeded along with clover in spring. For meadow, a mixture of alsike clover, timothy, red clover, and alfalfa is more satisfactory than the popular mixture of red clover and timothy.

These soils should be tested for acidity every 3 or 4 years, and enough lime should be used to maintain a reaction of 6.5 or higher, which is sufficient for the normal growth of alfalfa and red clover.

They need nitrogen, phosphorus, and potassium, but mainly the latter two, to better balance the moderate natural nitrogen content.

Soil structure is rapidly destroyed by continuous cultivation unless raw organic matter is regularly returned to the soil. Crop residues, barnyard manure, and green manure help to maintain soil structure.

Even where they are drained, these soils are often too wet for early plowing, and there may be only a short period in the spring when the soils are in good condition for cultivation.

When drained, group 4 soils provide some of the best pasture in the county. Bluegrass, white clover, and Ladino clover are well-adapted pasture plants. Pasture management suggestions given for group 2 are applicable to this group of soils.

MANAGEMENT GROUP 5

Group 5 is made up of undulating or gently undulating, moderately well drained to somewhat excessively drained, light-colored, moderately deep to deep soils of the terraces and uplands. This group covers about 19.7 percent of the county and contains the following soils:

Bellefontaine silt loam, undulating phase.
Celina silt loam, undulating phase.
Fox fine sandy loam, gently undulating phase.
Fox loam, gently undulating phase.
Fox silt loam, gently undulating phase.
Fox silt loam, gently undulating deep phase.
Fox silt loam, gently undulating shallow phase.
Kendallville silt loam, undulating phase.
Miami silt loam, undulating phase.
Mill Creek silt loam, gently undulating phase.
Milton silt loam, gently sloping phase.
Warsaw silt loam, gently undulating phase.

The Warsaw soil is somewhat darker colored than the others in the group.

Group 5 soils are good to very good for crops or for pasture. In most places accelerated sheet erosion has removed about half of the topsoil, but enough remains to form practically the full depth of the plow layer. All of the soils are friable throughout and moderately permeable to moisture, air, and plant roots. Surface runoff is medium. Internal drainage is medium to rapid. Water-absorbing capacity is good. Water-holding capacities are best in the Celina, Milton, Miami, and Kendallville soils and poorest in the Fox soils. In dry seasons, the Fox soils, especially the shallower phases, do not retain enough moisture for optimum yields of corn or soybeans.

The soils of this group are moderately fertile and moderately acid. They respond to good management and are productive of adapted crops in favorable seasons. Tilth is good over a wide range of moisture conditions. The soils dry out rapidly and can be cultivated soon after rainy periods. Erosion can be controlled by good management. Tilth and productivity are easily maintained.

Use suitability and management requirements.—Suitabilities for use are about the same as for the soils of group 2, but management requirements are more exacting and productivity is slightly lower in dry seasons. Longer rotations are advisable, and measures for control of water and erosion are needed. Suitable rotations and supplementary practices are presented in table 4.

Wheat is preferable to oats as a small grain crop because it provides winter cover. The meadow mixture should include red clover, alfalfa, timothy, and possibly some bromegrass and orchardgrass.

These soils are moderately fertile but to varying degree are deficient in lime, phosphorus, nitrogen, and potassium. Lime requirements should be determined by soil tests. Enough lime should be applied once during the rotation to keep the reaction at 6.5, which is sufficient for normal growth of all crops. Specific fertilizer requirements for various crops should be determined by soil tests. The organic content of the soils can be replenished by incorporating all crop residues and applying barnyard manure, especially on crops of corn and small grains.

Group 5 soils can be tilled over a fairly wide range of moisture conditions. Tillage should be on the contour wherever feasible. Terracing, stripcropping, or other measures for control of runoff and erosion are advisable if the rotation includes less than 3 years of meadow in 5 years.

These soils are well suited to pasture. Management and fertilizer requirements are similar to those suggested for group 2, and the same pasture plants are suitable.

MANAGEMENT GROUP 6

Group 6 is made up of nearly level or gently undulating, imperfectly drained to moderately well drained, light-colored soils of the uplands and terraces that are fair to very good for crops and good to very good for pasture. The group covers about 15 percent of the county and contains the following soils:

Celina-Crosby silt loams, nearly level phases.
Crosby silt loam, gently undulating phase.
Crosby silt loam, nearly level phase.
Homer silt loam.
Randolph silt loam.

Group 6 soils are fairly easy to work and very easy to conserve, but they are less fertile than the well-drained, light-colored soils of the county. Surface runoff is slow to medium, and internal drainage is impeded by a high water table and clayey subsoil. The surface soils are subject to extremes of moisture content. They are excessively wet in winter and early in spring but become extremely dry in summer and early in fall, when the water table is normally lower. When not excessively wet, the friable surface soils are permeable to air, moisture, and roots. The subsoils are likely to be plastic and sticky, and they are very slowly permeable to air and moisture and almost impenetrable to roots. Consequently, drainage of the surface layers is impaired. Artificial drainage by tiling would correct this condition, except in extremely wet years. Even when drained and well managed, these soils vary in productivity from year to year. Productivity is highest in seasons of low rainfall, somewhat lower in average seasons, and lowest in seasons when rainfall is excessive.

Tilth is good, except when the soils are very wet. Relief is favorable for the use of farm machinery. However, the soils dry out so slowly in the spring that preparation for spring-planted crops is sometimes seriously delayed.

Use suitability and management requirements.—Artificial drainage to remove excess surface water and to lower the water table is the primary management requirement. Tile underdrainage is preferable to surface drainage. Suggestions for spacing and depth of tiles are given in table 4. To be sure of an even grade and uniform fall, tiling systems should be designed and installed by a drainage engineer.

All soils in group 6 are medium to strongly acid. Lime is needed for most of the common crops; the amount necessary should be determined by soil tests.

The organic-matter content and nitrogen content are naturally low and have been further reduced by continuous cropping to such degree that in some places the soils tend to puddle. The remedy for this condition is to add to the soil more organic matter than is used by crops. All available barnyard manure, and all plant residues and cover crops, should be plowed under. Clover or some other legume should be grown and turned under every 2 or 3 years to supply nitrogen. A growing crop should be on the soil through the winter to prevent the leaching of soluble nitrogen and to prevent erosion. Barnyard manure may also be used as a topdressing on winter wheat; it will improve the crop and protect it from winter injury, and also assure a better stand of clover or of other crops seeded in the wheat. A topdressing of about 20 pounds of nitrogen to the acre is also beneficial if growth of spring wheat is poor.

Group 6 soils are deficient in available phosphorus, nitrogen, and potassium. Practically all of the phosphorus requirements of crops must be supplied by applications of manure or commercial fertilizer. All nonleguminous crops require additional nitrogen. Potassium is present in the soils in fair quantities, but the amount available to crops is small. Fertilizer requirements for specific crops should be determined by soil tests.

If properly drained, limed, and fertilized, these soils are well suited or moderately well suited to corn, soybeans, pasture and meadow grasses, alsike clover, Ladino clover, red clover, and the small grains. Alfalfa is suitable only where the best possible drainage has been established.

The basic rotation of corn or soybeans, a small grain, and then 2 years of a legume-grass mixture is best for these soils. If soybeans are grown instead of corn, the rotation may be shortened by cutting the meadow stand to 1 year; or it may be lengthened by keeping the meadow stand an extra year for hay or pasture. A good meadow mixture should contain some Ladino and alsike clovers, which will tolerate wet soil conditions, besides the timothy, alfalfa, and red clover.

When drained, these soils are well suited to pasture. Pastures of good quality and yield can be established by good management. Fertilizer requirements should be determined by soil test. Enough lime should be used to maintain a reaction of 6.3 or higher. Bluegrass, white clover, and Ladino clover are suitable pasture plants.

MANAGEMENT GROUP 7

Group 7 is made up of eroded undulating or sloping, light-colored, deep, soils of the uplands and terraces. Drainage varies from moderately well drained to somewhat excessively drained. Slopes range from 2 to 5 percent. Runoff and internal drainage are medium. The group contains the following soils:

Bellefontaine silt loam, eroded undulating phase.
Celina silt loam, eroded undulating phase.
Fox gravelly loam, eroded gently undulating phase.
Fox silt loam, eroded gently undulating phase.
Kendallville silt loam, eroded undulating phase.
Miami silt loam, eroded undulating phase.
Milton silt loam, eroded gently sloping phase.

Largely as a result of misuse and poor management, the soils of this group are moderately but unevenly sheet eroded. More than 50 percent of the surface soil has been removed over most of the acreage, and in places erosion has progressed to a point where 25 percent of the subsoil has been lost. In most places, however, the plow layer still consists mostly of original surface soil, mixed with smaller amounts of subsoil.

Group 7 soils are moderately productive under common management but are hard to work and to conserve. They are readily permeable to both air and roots. The subsoils permit percolation of water and hold moisture fairly well. Erosion has reduced the water-absorbing and water-supplying capacities of the soils and increased the rate of runoff. Further erosion is likely, unless good management practices are followed.

Tilth has been adversely affected by erosion. In severely eroded spots the soils tend to clod and puddle if worked when excessively wet. Heavy equipment can be used except when the soils are very wet.

Use suitability and management requirements.—These soils are well suited to small grains, grasses, red clover, Ladino clover, and alfalfa. They are only moderately well suited to corn, soybeans, and other shallow-rooted crops having high moisture requirements. In the severely eroded patches, heaving and winterkilling may damage winter small grains, legumes, and some grasses.

Crop rotations similar to those suggested for the soils of group 5 (table 4) may be used, provided at least 2 years of sod crops are included. If a row crop is grown, particular attention must be paid to controlling erosion. Wheat is preferable to oats as a small grain, because it protects the soil through the winter. Mixtures of alfalfa, red clover, timothy, and possibly some bromegrass and orchardgrass are suitable for meadow seedings. The Fox soils may be too dry for corn, but soybeans, alfalfa, and sweetclover may be grown on these soils under good management.

Artificial drainage is not generally needed, but some of the wetter areas of the Celina soil would be more suitable for alfalfa and sweetclover if the drainage were improved by tiling. (See tiling suggestions given for group 6 in table 4.)

Group 7 soils are medium to strongly acid and need lime. Tests for lime requirements should be made every 3 or 4 years, and enough lime should be applied once during the rotation to maintain a pH value of 6.5. These soils are especially deficient in organic matter and nitrogen. A large part of the requirement for these materials can be met by growing legumes in the rotation, incorporating all crop residues, plowing under the sod of the meadow crop, and applying barnyard manure. Most of the barnyard manure should be applied before the corn crop. Smaller amounts can be used profitably on wheat as topdressing in the spring. A topdressing of about 20 pounds an acre of nitrogen, applied late in winter, will generally increase wheat yields. The soils are also low in available phosphorus and potassium. Fertilizer requirements for specific crops should be determined by soil tests.

Erosion control is of major importance in the management of these soils. Cultivation should be on the contour, and small gullies or draws that form natural waterways down the slopes should be kept

permanently in grass. Stripcropping may be practical where the slopes are long and fairly uniform. Where the slopes are long and uniform, terracing may be practicable. Where group 7 soils are closely associated with less erodible soils, it may be possible to check erosion merely by eliminating row crops from the rotation.

These soils are good to very good for pasture. Pasture management should be similar to that suggested for the soils of group 2. Fertilizer requirements for pasture may be obtained by making soil tests.

MANAGEMENT GROUP 8

Group 8 is made up of slightly to moderately eroded, light-colored rolling or sloping soils of the terraces and uplands. Drainage is good to somewhat excessive. Surface runoff and internal drainage are rapid to medium. The group covers about 6.6 percent of the county and includes the following soils:

Bellefontaine silt loam, gently rolling phase.
Bellefontaine silt loam, eroded gently rolling phase.
Fox silt loam, eroded sloping phase.
Kendallville silt loam, gently rolling phase.
Kendallville silt loam, eroded gently rolling phase.
Miami silt loam, gently rolling phase.
Miami silt loam, eroded gently rolling phase.
Milton silt loam, eroded sloping phase.

Group 8 soils are fair to good for crops and good to very good for pasture. They are moderately productive under common management but rather difficult to work and to conserve. About 75 percent of the total acreage in this group is moderately sheet eroded; the rest is mostly wooded and is uneroded or only slightly eroded. Even where erosion is most advanced, enough of the original surface soil remains to form most of the plow layer.

Moisture-absorbing capacity has been decreased by erosion, and, although the subsoils have fair to good moisture-retaining capacity, most of the rainfall runs off. Moisture conditions are best in the Milton soil and poorest in the Fox and Bellefontaine soils. The soils are all readily permeable to plant roots and are well aerated.

Group 8 soils are somewhat deficient in plant nutrients, lime, and organic matter, but their productivity can be built up by good management. Control of soil erosion and of water loss is a major problem in their management.

Tilth has been adversely affected by erosion. Because some of the mellow original surface soil has been lost, the present plow layer is finer textured and tends to puddle and, subsequently, to clod and bake. The range of moisture content within which the soils can safely be tilled is narrow. Because of the rolling slopes, it is rather difficult to use farm machinery.

Use suitability and management requirements.—Soils of group 8 are about the same in use suitability and management requirements as the soils of group 7. Rotations should cover at least 4 years. Probably the best rotation consists of corn, wheat or oats, and then 2 or more years of legume-grass meadow. If oats are to be grown, a winter cover crop should be planted after the corn crop. Intertilled crops should not be grown oftener than once every 4 years.

Mixtures of red clover, Ladino clover, timothy, alfalfa, and possibly some orchardgrass and bromegrass make desirable meadow seedings. However, the common red clover-timothy mixture is adequate and well adapted.

The soils are naturally low in nitrogen and organic matter, and the supplies have been further depleted by erosion and continuous cultivation. In large part the nitrogen and organic matter requirements may be met by growing legumes in the rotation, plowing under all crop residues (including the meadow crop) and winter cover crops, and applying barnyard manure. Most of the available manure should be used on the corn crop. Smaller amounts may be profitably applied to wheat as a topdressing in spring. A topdressing of about 20 pounds an acre of nitrogen on wheat early in spring, in addition to the regular fertilization at seeding, may give profitable increases in yields.

Erosion control is a serious problem on these soils. Choice and rotation of crops, judicious tillage, and use of amendments will help, but stripcropping, terracing, or field diversions are also needed for adequate control. Stripcropping appears to be more practicable on the irregular slopes, and terraces are preferable on some of the long, uniform slopes. All the small gullies and draws that form natural waterways down slopes should be permanently in grass. Some small areas of these soils are intricately associated with other soils that are less susceptible to erosion and better suited for crops. In these places it may be possible to control erosion adequately without special engineering devices, if the row crop is eliminated from the rotation.

Good pastures are easily established and maintained on these soils. Pasture management practices suggested for group 2 soils are applicable. Bluegrass, white clover, Ladino clover, bromegrass, and alfalfa are well-adapted pasture plants. The trash-mulch method of seeding the clover, bromegrass, and alfalfa has been successfully tested in the county.

MANAGEMENT GROUP 9

Group 9 is made up of dark-colored very poorly drained organic (muck) soils of the terraces. They occur in level areas or shallow depressions that, until they were drained, were semipermanent ponds or bogs. There is practically no runoff, and the water table is at the surface much of the time. This group covers only about 1.8 percent of the county and includes the following soils:

Carlisle muck.
Carlisle muck, shallow phase.
Carlisle silty muck, shallow phase.
Warners loam.

These soils are high in organic matter and nitrogen, but their supplies of phosphorus, potassium, and certain minor elements are very low. Even when artificially drained, the soils are excessively wet most of the year. In midsummer, especially if there is a prolonged period of dry weather, the upper muck layers may become dry, loose, and chaffy, although the water table remains close to the surface. Tilth is excellent, even when the soils are wet, and remains good even under unfavorable management. When drained, the muck layers are readily permeable to moisture, air, and plant roots, but

the fine-textured mineral subsoils are very slowly permeable at all times.

Use suitability and management requirements.—Unless artificial drainage is provided, these soils are entirely unsuitable for crops and poorly suited to pasture. Improving the drainage is extremely difficult, because of the basinlike relief, the high water table, the lack of outlets, and, in the shallow soils, the shallowness of the muck layers over clay.

If drainage outlets can be found and the water table lowered 2 or 3 feet, the muck layers will drain freely. It may be necessary to use open ditches for outlets in some areas, but if the subsurface material is firm, tiling is preferable. Where muck areas adjoin higher land, diversion ditches or tiles should be provided to remove seepage water.

The depth at which the tiles are set in these muck soils is important. If they are placed too deep, the soils may be excessively drained and in very dry weather may not retain enough moisture for crops. On the other hand, the tiles should be deep enough to allow for settling of the soil over a newly installed tile line. Covering the tile with a few inches of straw or grass, before filling in the ditch, will keep dirt from seeping into the line while the ground is settling. An even grade must be established for each line of tile; otherwise, fine soil materials will wash in at the joints and clog the line. As a rule, nothing smaller than a 5-inch tile should be used.

During dry seasons, it may be advisable to raise the water table in some drained areas, especially if shallow-rooted crops are grown on the shallow soils. This can be done by temporarily blocking the drainage outlets. Overhead irrigation may be beneficial where the soils are intensively cultivated.

Good pastures can be produced without the use of lime or nitrogen, but phosphorus and potassium are required for satisfactory growth. Requirements should be determined by soil tests. Weeds should be controlled by regulated grazing and frequent clipping. Clipping may be difficult because the soils are often too wet and soft to accommodate mowing machines.

Under optimum drainage, soils of group 9 may be used for all common field and garden crops except wheat, oats, barley, alfalfa, and possibly red clover. Alfalfa and red clover, however, are grown successfully on some of the deeper and better drained areas of Carlisle muck. For the general farmer, corn is the best crop. It can be grown successfully almost continuously, if plenty of potassium and phosphorus are used. Early varieties should be planted, so that the crop will mature before the early fall frosts. Soybeans, rye, or mixed timothy and alsike clover for hay or pasture are suitable crops to be alternated with corn. Potatoes, followed by a cover crop of rye, may also be fitted into the rotation. Small grains are the least suitable crops for muck soils; they produce a rank growth of weak straw and are apt to lodge. Phosphorus and liberal applications of potassium will help in producing stiffer straw. Onions, cabbage, potatoes, cauliflower, kale, turnips, rutabagas, celery, lettuce, parsnips, beets, carrots, and sweet corn do well on these soils if they have been drained and fertilized.

Muck soils are likely to be loose at the surface. When the seedbed is prepared, the ground should be thoroughly packed by heavy rollers or cultipackers. This practice creates better conditions for crop growth and helps reduce damage from early frosts.

MANAGEMENT GROUP 10

Group 10 is made up of eroded or severely eroded, gentle undulating, well-drained, light-colored, moderately deep soils of the terraces and uplands. Slopes range from 5 to 10 percent. Runoff is rapid to very rapid, and internal drainage is medium to rapid, depending on the parent material. Productivity is moderately good to fair, but the soils are difficult to work and to conserve. This group covers about 3.8 percent of the county and consists of the following soils:

Bellefontaine silt loam, severely eroded gently rolling phase.
Fox silt loam, eroded sloping shallow phase.
Fox silt loam, severely eroded gently undulating phase.
Fox silt loam, severely eroded sloping phase.
Fox gravelly loam, eroded sloping phase.
Fox gravelly loam, severely eroded sloping phase.
Kendallville silt loam, severely eroded gently rolling phase.
Miami silt loam, severely eroded gently rolling phase.
Milton silt loam, severely eroded sloping phase.

These soils are friable to firm and readily permeable to air and plant roots. Only a small amount of rainfall is absorbed by the surface soils. The thick clayey subsoils allow free percolation of water and have poor to good moisture-holding capacity. The supplies of organic matter, nitrogen, and other plant nutrients were never abundant and have been materially reduced by long-continued misuse, poor management, and erosion.

Erosion is a very serious problem on these soils. Practically all of the original surface soil and more than 25 percent of the subsoil have been removed by accelerated sheet erosion. Shallow gullies have formed in a few places. To a large extent, this damage is the result of misuse and poor management. Further erosion is likely, unless preventive measures are taken.

Tilth was originally good, but it has been adversely affected by erosion. The present plow layers are fine textured and difficult to work. The soils dry out fairly rapidly and can be worked soon after wet periods, but they can be cultivated without damage only within a very narrow range of moisture content. If they are worked when they are too wet, the surface soils tend to puddle and clod. Because of the fairly strong slopes, the use of farm equipment is somewhat difficult.

Use suitability and management requirements.—These soils are poorly suited to crops and are best suited to pasture. Fertilizer and lime are needed for good pasture growth. Requirements should be determined by soil tests. If the pH is below 6.3, enough lime should be added to bring the reaction to a pH of 6.5. Thereafter, one ton of ground limestone to an acre every 6 to 8 years should be sufficient. Reseeding impoverished pastures is rarely necessary. Good management, including fertilization, liming, weed control, and regulation of grazing, will improve the quality of pastures. Barnyard manure or green-manure crops will help new seedings to become established.

Bluegrass, white clover, Ladino clover, alfalfa, and bromegrass are suitable pasture plants. Most of the present pastures are of bluegrass and white clover. Pastures of Ladino clover, alfalfa, and bromegrass, established by trash-mulch seeding, are increasing.

Bluegrass is very adaptable; it grows vigorously and may crowd out other plants, except possibly white clover. To maintain a balanced pasture, periodic reseeding of Ladino clover, alfalfa, and bromegrass may be necessary.

Fields where small areas of these soils are intricately associated with soils more suitable for crops may be used entirely for crops if water and erosion are controlled. As a rule, no intertilled crops should be grown. A 3- or 4-year rotation of small grain and legume-grass meadow for 2 or more years is moderately well suited. Cultivation should be on the contour. Lime and fertilizer requirements should be determined by soil tests.

After a few years in pasture, these soils may be suitable for row crops for short periods. A 7- to 10-year rotation consisting of corn, small grain, and legume-grass meadow for 2 or more years might be used. Management requirements would be similar to those suggested for the same rotation in management group 8, except that greater care would be required to control erosion.

MANAGEMENT GROUP 11

Group 11 is made up of moderately to severely eroded, well-drained to excessively drained, light-colored soils of the terraces and uplands. Slopes range from 10 to 35 percent. Runoff is rapid to very rapid; internal drainage is medium to very rapid, depending largely on the depth of the soil and the porosity of the underlying parent material. This group covers 4.8 percent of the total land area of the county and includes the following soils:

Bellefontaine loam and silt loam, rolling phases.
Bellefontaine loam and silt loam, eroded rolling phases.
Bellefontaine loam and silt loam, severely eroded rolling phases.
Bellefontaine loam and silt loam, eroded hilly phases.
Fox gravelly loam, eroded strongly sloping phase.
Fox gravelly loam, moderately steep phase.
Miami silt loam, eroded rolling phase.
Miami silt loam, severely eroded rolling phase.
Miami silt loam, hilly phase.
Miami silt loam, eroded hilly phase.
Milton silt loam, gently sloping shallow phase.
Milton silt loam, eroded sloping shallow phase.
Milton silt loam, eroded strongly sloping shallow phase.
Rodman gravelly loam, eroded sloping and strongly sloping phases.

The Milton and Rodman soils are shallow; their relief is smoother than that of the other soils of the group, and their water-supplying capacity is lower, but they are similar to the others in use suitability and management problems.

The soils of this group are very permeable to water, roots, and air but they vary in their capacity to absorb and hold moisture. The Milton soils are poor and the Rodman soils very poor in water-supplying capacity. The other soils of the group have somewhat better, though still low, water-supplying capacity.

All of the soils have been affected by accelerated sheet erosion varying from slight to severe. The least eroded areas are mostly woodland. All of the soils of the group are easily eroded if cultivated.

Both the Milton and Rodman soils contain enough stones to interfere with cultivation, if cultivation were otherwise feasible.

Tilth is fair in moderately eroded areas and poor in severely eroded areas. Accessibility to farm equipment is generally poor.

Use suitability and management requirements.—Group 11 soils, in general, are too steep, too difficult to work, and too easily eroded to be suitable for crops. Good pastures can be produced in favorable seasons, if the soils are fertilized and limed, and if suitable pasture plants are selected, weeds are controlled, and grazing is regulated. All of the soils except the Rodman will need periodic liming. Pasture management practices similar to those suggested for the soils of group 10 are applicable to soils of this group.

MANAGEMENT GROUP 12

Management group 12 is made up of soils and land types unsuitable for crops or pasture. This group covers only 0.6 percent of the county and includes the following:

Made land.
Rodman gravelly loam, eroded steep phase.
Steep land-limestone outcrop.

Made land, unsuitable for any kind of agriculture, has been placed in this group only for convenience in coloring the soil map. It is discussed on p. 63. The two other soils are readily permeable to plant roots, air, and moisture, but the moisture-holding and moisture-supplying capacities are very low. Productivity is fair to poor. The surface soils are typically neutral or very slightly acid; the lower layers are usually alkaline. Tilth is poor and accessibility to farm machinery is very poor.

Use suitability and management requirements.—These soils are best suited as woodland. Most of the areas have not been cleared. Those that have are almost entirely in permanent pasture. Some areas where these soils are associated with other more suitable soils can profitably be used for pasture. Generally, however, group 12 soils should not be in pasture unless grazing land is badly needed and no other more suitable soils are available. Black locust or redcedar can be grown on these soils. Lespedeza or sweetclover may be useful to control erosion until trees can be established.

Legumes should make up a high proportion of pasture sod. Management practices suggested for group 10 are applicable, but the terrain makes it difficult to apply fertilizer and seed and to control weeds.

Good management of woodlands on group 12 soils requires protection from damage by grazing, trampling, and other causes; systematic cutting and weeding; harvesting of mature trees; and maintenance of a full stand of useful species.

ESTIMATED CROP YIELDS

Table 5 shows estimated average yields per acre for the principal crops grown in Clark County, under prevailing management, and estimates of the yields that would be likely under improved management. The estimates are based on information obtained through field observations, and from consultation with farmers, the County Agent, agricultural specialists of the State Agricultural Experiment Station and of the Extension Service of Ohio State University, the Soil Conservation Service, and from other local sources. Exact records of actual yields were not available.

TABLE 5.—*Estimated acre yields under two levels of management for princi*

[A columns give estimated yields obtained under prevailing management; B columns give estimates of yields that may be e
on productivity ratings compiled by Ohio Agricultural Experiment Station and Ohio State University in

Map symbol	Soil	Corn		Wheat		Oats		Soybeans		Alfalfa hay		Red c h
		A	B	A	B	A	B	A	B	A	B	A
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
AA	Abington silty clay loam (drained)	60	75	15	23	25	33	25	28	2.8	3.2	1.6
AB	Algiers silt loam:											
	Drained and protected from flooding	60	70	18	21	33	38	25	28	2.8	3.4	1.5
	Drained but unprotected from flooding	58	68	10	------	30	35	24	26	1.6	------	1.4
	Bellefontaine silt loam:											
BK	Undulating phase	38	55	28	34	38	45	15	18	3.2	3.8	1.6
BF	Eroded undulating phase	28	40	23	28	30	35	11	14	2.6	3.2	1.4
BG	Gently rolling phase	30	45	23	28	30	35	11	15	2.6	3.4	1.3
BE	Eroded gently rolling phase	25	38	20	25	28	33	12	14	2.6	3.0	1.3
BH	Severely eroded gently rolling phase	18	------	14	18	18	23	8	------	2.2	2.6	1.1
	Bellefontaine loam and silt loam:											
BC	Rolling phases	25	------	20	------	28	------	11	------	2.4	------	1.2
BB	Eroded rolling phases	23	------	16	------	23	------	9	------	2.2	------	1.1
BD	Severely eroded rolling phases	15	------	14	------	15	------	6	------	2.0	------	1.0
BA	Eroded hilly phases	15	------	14	------	15	------	6	------	2.0	------	1.0
BL	Bronson silt loam	33	55	20	30	30	35	18	20	2.6	3.4	1.2
BN	Brookston silty clay loam (drained)	50	70	18	25	35	43	25	28	2.8	3.2	1.6
BM	Brookston silt loam (drained)	48	68	19	26	35	43	25	28	3.0	3.4	1.7
CA	Carlisle muck (drained)	40	70	10	------	20	------	20	35	1.6	------	1.0
CB	Shallow phase (drained)	38	63	10	------	20	------	19	31	1.2	------	.8
CC	Carlisle silty muck, shallow phase (drained)	40	65	10	------	20	------	20	33	1.2	------	.8
	Celina silt loam:											
CE	Undulating phase	33	55	18	28	30	38	18	20	2.2	3.0	1.2
CD	Eroded undulating phase	25	40	14	23	25	30	13	16	1.8	2.6	1.0
CG	Celina-Crosby silt loams, nearly level phases (drained)	33	53	16	25	28	38	19	23	2.2	2.8	1.1
	Crosby silt loam:											
CK	Nearly level phase (drained)	35	50	15	23	25	35	20	24	2.0	2.6	1.0
CH	Gently undulating phase (drained)	30	50	16	23	28	38	20	24	2.0	2.8	1.0
EA	Eel silt loam:											
	Protected from flooding	60	70	19	23	35	40	25	28	3.0	3.6	1.6
	Unprotected from flooding	58	68	10	------	30	35	24	26	1.8	------	1.4

	Fox silt loam:											
FT	Nearly level phase	40	58	28	35	38	45	16	20	3.2	4.0	1.7
FP	Gently undulating phase	38	55	28	35	38	45	15	18	3.0	3.8	1.6
FL	Eroded gently undulating phase	28	40	23	28	30	35	11	13	2.6	3.2	1.4
FV	Severely eroded gently undulating phase	18	------	16	21	18	25	8	------	2.0	2.4	1.0
FM	Eroded sloping phase	25	40	20	28	30	38	11	14	2.4	3.0	1.3
FW	Severely eroded sloping phase	18	------	14	18	18	23	8	------	2.0	2.6	1.1
FS	Nearly level deep phase	43	60	28	35	38	45	18	20	3.2	4.0	1.7
FO	Gently undulating deep phase	40	58	28	35	38	45	16	19	3.2	3.8	1.6
FU	Nearly level shallow phase	33	43	23	17	33	38	14	16	2.8	3.6	1.6
FR	Gently undulating shallow phase	30	40	21	26	30	35	13	15	2.6	3.4	1.5
FN	Eroded sloping shallow phase	25	------	19	24	25	30	10	------	2.2	3.0	1.3
	Fox fine sandy loam:											
FB	Nearly level phase	35	48	20	28	28	38	13	16	2.8	3.6	1.4
FA	Gently undulating phase	33	45	19	26	25	35	11	15	2.6	3.4	1.3
	Fox gravelly loam:											
FE	Eroded sloping phase	20	------	19	24	23	28	9	------	2.0	2.6	1.1
FC	Eroded gently undulating phase	25	38	21	26	28	33	10	13	2.4	3.0	1.3
FG	Severely eroded sloping phase	15	------	16	21	20	25	8	------	2.2	2.4	1.0
FF	Eroded strongly sloping phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(2)	(3)
FD	Moderately steep phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
	Fox loam:											
FH	Gently undulating phase	35	48	21	29	28	35	13	16	2.8	3.4	1.3
FK	Nearly level phase	38	50	23	30	30	38	14	18	3.0	3.6	1.4
GB	Genesee silt loam:											
	Protected from flooding	65	75	23	25	38	43	25	28	3.6	4.4	1.8
	Unprotected from flooding	60	70	10	------	33	38	24	28	1.2	------	1.7
GA	Genesee loam:											
	Protected from flooding	60	70	23	25	38	43	24	26	3.4	4.2	1.7
	Unprotected from flooding	55	65	10	------	33	38	23	25	1.0	------	1.6
HA	Homer silt loam (drained)	30	50	15	23	25	35	18	21	1.8	2.4	1.0
	Kendallville silt loam:											
KE	Undulating phase	38	55	18	28	23	30	16	19	2.8	3.6	1.4
KB	Eroded undulating phase	30	45	16	26	25	33	15	18	2.4	3.2	1.2
KC	Gently rolling phase	35	53	18	28	25	33	15	18	2.6	3.4	1.3
KA	Eroded gently rolling phase	23	43	15	23	23	30	14	16	2.4	3.2	1.2
KD	Severely eroded gently rolling phase	20	33	10	15	15	20	10	11	2.0	2.4	1.0
KF	Kokomo silty clay loam (drained)	60	75	15	23	25	33	25	28	2.8	3.2	1.6
MA	Mahalasville silty clay loam (drained)	50	70	18	25	35	43	25	28	2.8	3.2	1.6
	Miami silt loam:											
MM	Undulating phase	38	55	18	28	28	35	16	19	2.8	3.6	1.4
MH	Nearly level phase	40	58	20	30	30	38	18	20	2.8	3.6	1.4
ME	Eroded undulating phase	30	45	16	26	25	33	15	18	2.4	3.2	1.4
MF	Gently rolling phase	35	54	18	28	25	33	15	18	2.6	3.4	1.3
MB	Eroded gently rolling phase	28	43	15	23	23	30	14	16	2.4	3.2	1.2
MK	Severely eroded gently rolling phase	20	33	10	15	15	20	10	11	2.0	2.4	1.0
MD	Eroded rolling phase	25	------	14	20	20	28	13	------	2.2	2.6	1.1
ML	Severely eroded rolling phase	18	------	10	15	15	20	10	------	2.0	2.4	1.0
MG	Hilly phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
MC	Eroded hilly phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(2)	(3)	(3)

For footnotes, see end of table.

TABLE 5.—*Estimated acre yields under two levels of management for principal*

[A columns give estimated yields obtained under prevailing management; B columns give estimates of yields that may be on productivity ratings compiled by Ohio Agricultural Experiment Station and Ohio State University in

Map symbol	Soil	Corn		Wheat		Oats		Soybeans		Alfalfa hay		Red h
		A	B	A	B	A	B	A	B	A	B	A
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
	Mill Creek silt loam:											
MO	Nearly level phase	43	60	28	35	38	45	18	20	3.2	4.0	1.7
MN	Gently undulating phase	40	58	28	35	38	45	16	19	3.2	3.8	1.6
MP	Millsdale silty clay loam (drained)	45	65	18	25	35	43	25	28	2.4	3.0	1.4
	Milton silt loam:											
MV	Gently sloping phase	38	55	18	28	30	38	18	20	2.8	3.6	1.4
MX	Nearly level phase	40	58	20	30	28	35	16	19	2.8	3.6	1.4
MR	Eroded gently sloping phase	30	45	16	26	25	33	15	18	2.4	3.2	1.2
MS	Eroded sloping phase	28	43	15	23	20	30	14	16	2.4	3.2	1.1
MY	Severely eroded sloping phase	20	28	9	14	15	20	9	10	2.0	2.6	1.0
MU	Eroded strongly sloping shallow phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
MW	Gently sloping shallow phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
MT	Eroded sloping shallow phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
NA	Needham silty clay loam (drained)	55	70	15	23	25	35	25	28	2.8	3.2	1.6
RA	Randolph silt loam (drained)	30	45	15	23	25	35	18	21	1.8	2.4	1.0
	Rodman gravelly loam:											
RC	Eroded steep phase	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
RB	Eroded sloping and strongly sloping phases	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
RE	Ross silty clay loam:											
	Protected from flooding	65	75	23	25	38	43	25	28	3.6	4.4	1.8
	Unprotected from flooding	65	75	10	------	38	40	24	26	1.2	------	1.6
RD	Ross silt loam:											
	Protected from flooding	63	73	24	26	40	45	25	28	3.6	4.4	1.8
	Unprotected from flooding	63	73	10	------	38	43	24	26	1.2	------	1.6
SA	Shoals silt loam:											
	Drained and protected from flooding	30	50	15	23	25	35	14	16	1.8	2.4	1.0
	Drained but unprotected from flooding	30	50	10	------	23	33	14	16	.8	------	.6
SC	Sloan silty clay loam:											
	Drained and protected from flooding	50	70	18	25	25	35	25	28	2.8	3.2	1.6
	Drained but unprotected from flooding	50	70	10	------	23	33	25	28	.8	------	1.4

SB	Sloan silt loam:											
	Drained and protected from flooding	48	68	19	26	25	35	25	28	3.0	3.4	1.7
	Drained but unprotected from flooding	48	68	10	------	23	33	25	28	.8	------	1.4
SD	Steep land-limestone outcrop	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
WB	Wabash silty clay loam:											
	Drained and protected from flooding	60	75	15	23	20	30	25	28	2.8	3.2	1.6
	Drained but unprotected from flooding	58	73	9	------	18	28	25	28	.8	------	1.5
WA	Wabash silt loam:											
	Drained and protected from flooding	58	73	16	24	20	30	25	28	3.0	3.4	1.7
	Drained but unprotected from flooding	55	70	11	------	18	30	25	28	.8	------	1.6
WC	Warners loam (drained)	35	55	13	------	25	------	18	28	1.4	------	.9
	Warsaw silt loam:											
WE	Nearly level phase	45	63	28	35	38	45	19	21	3.2	4.0	1.6
WD	Gently undulating phase	43	60	27	34	35	43	18	20	3.0	3.8	1.5
WF	Wawaka silt loam	43	60	23	31	33	40	18	20	2.8	3.6	1.4
WH	Westland silty clay loam (drained)	50	70	18	25	35	43	25	28	3.0	3.4	1.6
WG	Westland silt loam (drained)	48	68	19	26	35	43	25	28	3.0	3.6	1.7

[1] Mostly timothy and red clover; some alfalfa. [2] Number of days 1 acre will graze a mature cow without injury to t

The "A" columns give estimated yields of the stated crops under the level of management commonly practiced. Prevailing management practices vary, but in general the soils that are naturally best suited to crops are also the best managed. Information on management of individual soils is contained in the section on use and management of soils, and on prevailing management, in the soil descriptions.

The "B" columns give estimates of the yields that could be obtained, on the average, by applying the best accepted methods of maintaining and increasing productivity. These methods include crop selection and systematic rotation; use of commercial fertilizers, lime, and manure; suitable tillage methods; replenishment of organic matter; and, where necessary, water and erosion control. The methods, in general, are those given in table 4. In some areas of Clark County, prevailing practices may represent the highest feasible level of management.

For bottom-land soils, table 5 gives estimated yields for areas protected from flooding and areas without such protection. For imperfectly or poorly drained soils that are unsuitable for crops unless artificially drained, estimates are given only for areas that have been drained.

The table of estimated acre yields does not indicate the relative importance of different soils in the agriculture of the county, which depends in a large degree on their extent, pattern of distribution, and geographic association. Estimated yields cannot be used as an interpretation of land values, because land values are influenced by distances to markets, relative prices of farm products, and other economic factors. The yield tables are useful, however, for comparing the productivity of different soils and for showing the results of improved management.

CAPABILITY GROUPS OF SOILS

The capability grouping is an arrangement of soils to show their suitability for crops, grazing, forestry, wildlife, or other uses, and the risks of erosion or other damage. It is widely used in helping farmers plan their practices for soil and water conservation.

Eight broad classes are provided in the capability arrangement, although some of them do not occur in Clark County. Each soil is placed in one of these broad classes after several persons have jointly studied ways it responds when used.

Soils that are easy to farm and have no serious limitations for use are placed in capability class I. Such soils are not subject to more than slight erosion, drought, wetness, or other limitations and are at least fairly fertile. They are good for many uses. The farmer can use his class I soils for crops without special practices, other than those needed for good farming, anywhere. He can choose one of several cropping patterns; or, if he wishes, he may use the soil for pasture, trees, or for other purposes.

Soils are placed in class II if they are a little less widely adaptable, and thus more limited than those in class I. For example, a gently sloping soil may have a slight erosion hazard that requires contour farming or other practices to control runoff. Other soils may be placed in class II because they are too droughty, too wet, or too shallow to be in class I. Climate can also be a limiting factor if too cool or too dry,

but it is not a limiting factor in the capability grouping for Clark County.

Class III contains the soils that are suitable for regular cropping but have more stringent management requirements than those in class II. The soils that are even more limited and have more narrow crop adaptations than those in class III but are still suitable for tillage part of the time, or with special precautions, are placed in class IV.

Soils not suitable for cultivation, or on which cultivation is not advisable, are in classes V, VI, VII or VIII. Class V consists of soils not subject to erosion but unsuited to cultivation because of stoniness, standing water, or frequency of overflow. Class VI contains the soils that are steep, droughty or shallow but will produce fairly good amounts of forage, orchard, or forest products. As a rule, class VI soils should not be cultivated, but some of them can safely be disturbed to prepare for planting trees or seeding long-producing forage crops.

Soils in class VII are more limited than those in class VI, require more care in handling, and usually give only fair to poor yields of forage or wood products. Class VIII consists of soils so severely limited that they produce little useful vegetation. They may make attractive scenery or may be parts of valuable watersheds. Some may have value for wildlife.

Subclasses: Although the soils within a single capability class present use and management problems of about the same degree, the kinds of problems may differ greatly. These problems and limitations of the different soils are caused by erosion, designated by the symbol (e), excess water (w), and low moisture capacity or low fertility (s).

The descriptions that follow give the general nature of the soils of Clark County in the various subclasses:

CLASS I.—Soils that are easy to farm and have no outstanding limitations to use. No subclasses are recognized in class I.

CLASS II.—Soils that can be used for tilled crops but are subject to slight limitation by risk of erosion or by other limitations of comparable degree.

IIe: Gently undulating soils subject to slight erosion.

IIs: Nearly level, well to somewhat excessively drained soils.

IIw: Nearly level soils with dominantly very slow to slow internal drainage.

CLASS III.—Soils that can be used for tilled crops but under moderate risk of erosion or under other limitations of a comparable degree.

IIIe: Gently undulating, gently rolling, and rolling, well drained to somewhat excessively drained erodible soils.

IIIw: Very poorly drained organic soils that need supplementary drainage.

CLASS IV.—Soils that have severe limitations for use and can be cultivated only with extreme care.

IVe: Gently undulating to rolling eroded to severely eroded soils with good to somewhat excessive drainage.

IVs: Nearly level soils limited by a moderately fine to fine textured subsoil and also by bedrock at depths of about 3 feet.

CLASS V.—Soils best suited to permanent vegetation because of stoniness, wetness, or frequency of overflow.

Vw: Very poorly drained, shallow, organic soils.

CLASS VI.—Soils that are too steep, too wet, too shallow, or too droughty for cultivation, except occasionally in preparation for reseeding long-producing hay or pasture or for replanting woody vegetation.

VIe: Rolling and hilly erodible soils.

CLASS VII.—Soils that are unsuited to any cultivation because they are too steep, too shallow, too droughty, or too wet.

VIIe: Steep, shallow soils and steep land with many rock outcrops.

The capability class and subclass for each soil is shown in the following list:

	Capability Class and Subclass
Abington silty clay loam (AA)	IIw.
Algiers silt loam (AB)	**IIw.**
Bellefontaine loam and silt loam:	
Eroded hilly phases (BA)	VIe.
Eroded rolling phases (BB)	IIIe.
Rolling phases (BC)	IIIe.
Severely eroded rolling phases (BD)	VIe.
Bellefontaine silt loam:	
Eroded gently rolling phase (BE)	IIIe.
Eroded undulating phase (BF)	IIe.
Gently rolling phase (BG)	IIIe.
Severely eroded gently rolling phase (BH)	IVe.
Undulating phase (BK)	IIe.
Bronson silt loam (BL)	I.
Brookston silt loam (BM)	IIw.
Brookston silty clay loam (BN)	IIw.
Carlisle muck (CA)	IIIw.
Shallow phase (CB)	Vw.
Carlisle silty muck, shallow phase (CC)	IIIw.
Celina silt loam:	
Eroded undulating phase (CD)	IIe.
Undulating phase (CE)	IIe.
Celina-Crosby silt loams, nearly level phases (CG)	IIw.
Crosby silt loam:	
Gently undulating phase (CH)	IIw.
Nearly level phase (CK)	IIw.
Eel silt loam (EA)	Iw.
Fox fine sandy loam:	
Gently undulating phase (FA)	IIe.
Nearly level phase (FB)	IIs.
Fox gravelly loam:	
Eroded gently undulating phase (FC)	IIe.
Moderately steep phase (FD)	VIe.
Eroded sloping phase (FE)	IIIe.
Eroded strongly sloping phase (FF)	IVe.
Severely eroded sloping phase (FG)	IVe.
Fox loam:	
Gently undulating phase (FH)	IIe.
Nearly level phase (FK)	IIs.
Fox silt loam:	
Eroded gently undulating phase (FL)	IIe.
Eroded sloping phase (FM)	IIIe.
Eroded sloping shallow phase (FN)	IIIe.
Gently undulating deep phase (FO)	IIe.
Gently undulating phase (FP)	IIe.
Gently undulating shallow phase (FR)	IIe.
Nearly level deep phase (FS)	I.
Nearly level phase (FT)	I.
Nearly level shallow phase (FU)	IIs.
Severely eroded gently undulating phase (FV)	IIIe
Severely eroded sloping phase (FW)	IV

	Capability Class and Subclass
Genesee loam (GA)	IIw.
Genesee silt loam (GB)	IIw.
Gravel pits	(1)
Homer silt loam (HA)	IIw.
Kendallville silt loam:	
Eroded gently rolling phase (KA)	IIIe.
Eroded undulating phase (KB)	IIe.
Gently rolling phase (KC)	IIIe.
Severely eroded gently rolling phase (KD)	IVe.
Undulating phase (KE)	IIe.
Kokomo silty clay loam (KF)	IIw.
Made land (M)	(1)
Mahalasville silty clay loam (MA)	IIw.
Miami silt loam:	
Eroded gently rolling phase (MB)	IIIe.
Eroded hilly phase (MC)	VIe.
Eroded rolling phase (MD)	IVe.
Eroded undulating phase (ME)	IIe.
Gently rolling phase (MF)	IIIe.
Hilly phase (MG)	VIe.
Nearly level phase (MH)	I.
Severely eroded gently rolling phase (MK)	IVe.
Severely eroded rolling phase (ML)	VIe.
Undulating phase (MM)	IIe.
Mill Creek silt loam:	
Gently undulating phase (MN)	IIe.
Nearly level phase (MO)	I.
Millsdale silty clay loam (MP)	IIw.
Milton silt loam:	
Eroded gently sloping phase (MR)	IVe.
Eroded sloping phase (MS)	IVe.
Eroded sloping shallow phase (MT)	IVe.
Eroded strongly sloping shallow phase (MU)	IVe.
Gently sloping phase (MV)	IVe.
Gently sloping shallow phase (MW)	IVe.
Nearly level phase (MX)	IVs.
Severely eroded sloping phase (MY)	IVe.
Needham silty clay loam (NA)	IIw.
Quarries	(1)
Randolph silt loam (RA)	I.
Rodman gravelly loam:	
Eroded sloping and strongly sloping phases (RB)	VIe.
Eroded steep phase (RC)	VIIe.
Ross silt loam (RD)	Iw.
Ross silty clay loam (RE)	Iw.
Shoals silt loam (SA)	IIw.
Sloan silt loam (SB)	IIw.
Sloan silty clay loam (SC)	IIw.
Steep land-limestone outcrop (SD)	VIIe.
Wabash silt loam (WA)	IIw.
Wabash silty clay loam (WB)	IIw.
Warners loam (WC)	IIIw.
Warsaw silt loam:	
Gently undulating phase (WD)	IIe.
Nearly level phase (WE)	I.
Wawaka silt loam (WF)	I.
Westland silt loam (WG)	IIw.
Westland silty clay loam (WH)	IIw.

[1] Not classified.

SOIL ASSOCIATIONS

Soil associations are groups of defined and named soil units that occur together in characteristic patterns. The soils that make up an association may differ in physical characteristics and in agricultural

suitability, but the proportions and distribution in each area where the association occurs will be fairly uniform. Generally, all the soils of an association have been derived from similar parent material. A generalized map showing the geographical distribution of soil associations is useful for comparing parts of the county and for locating areas suitable for specific kinds of farming (fig. 2).

Brief discussions of the nine soil associations of Clark County follow. Detailed descriptions of each of the soils can be found in the section, The Soils of Clark County.

1. MIAMI-KENDALLVILLE-CELINA-CROSBY

Association 1 is the most extensive in the county. All the soils except the Kendallville have developed chiefly from unassorted calcareous glacial till. The Kendallville soils are underlain by glacial till containing thin lenses of gravel and sand. The well-drained Miami soils are the most extensive; the Kendallville, Celina, Crosby, and Brookston soils, in approximately that order, are less extensive but are important in the association. There are minor acreages of Kokomo, Wawaka, and Bellefontaine soils in the uplands, and small areas of first-bottom soils along the streams.

Relief ranges from almost level to steep but is predominantly undulating to rolling. Especially in the eastern part of the county, this association occurs mostly on glacial moraines. To a lesser extent, it is found along the major drainageways that have dissected the glacial till plains, especially along the western and northern valley walls of the Mad River.

The soils of this association are derived from similar, though not identical, parent material. They differ somewhat but not widely in natural content of plant nutrients and lime. All are deep or moderately deep. Their differences result largely from differences in relief and drainage. Most are well drained, but the range is from somewhat excessive to very poor, and agricultural suitability varies accordingly. The Kendallville soils are concentrated in the northeastern part of the county, and the Wawaka soil occurs mostly north and south of Springfield. The other soils of the association occur in fairly uniform proportions in each association area.

Probably more than 90 percent of the total area of association 1 is cleared and used for crops or pasture. The forested areas are largely on the steeper phases of Miami and Kendallville, or on small patches of Crosby soils. The predominant types of agriculture are general farming and dairying. Dairying is concentrated mainly in Pleasant Township. Livestock farming is secondary. Soil management is generally fairly good, but more intensive soil conservation practices are needed.

As a group the soils are well suited to the production of small grains, grasses, and alfalfa and other legumes, but they are only moderately well suited to corn, soybeans, and other crops having high moisture requirements. The well-drained Miami and Kendallville soils occupy stronger relief than the other soils of the association and are particularly subject to accelerated erosion. All the soils are productive or moderately productive under good management. They are best suited to the types of agriculture that now predominate.

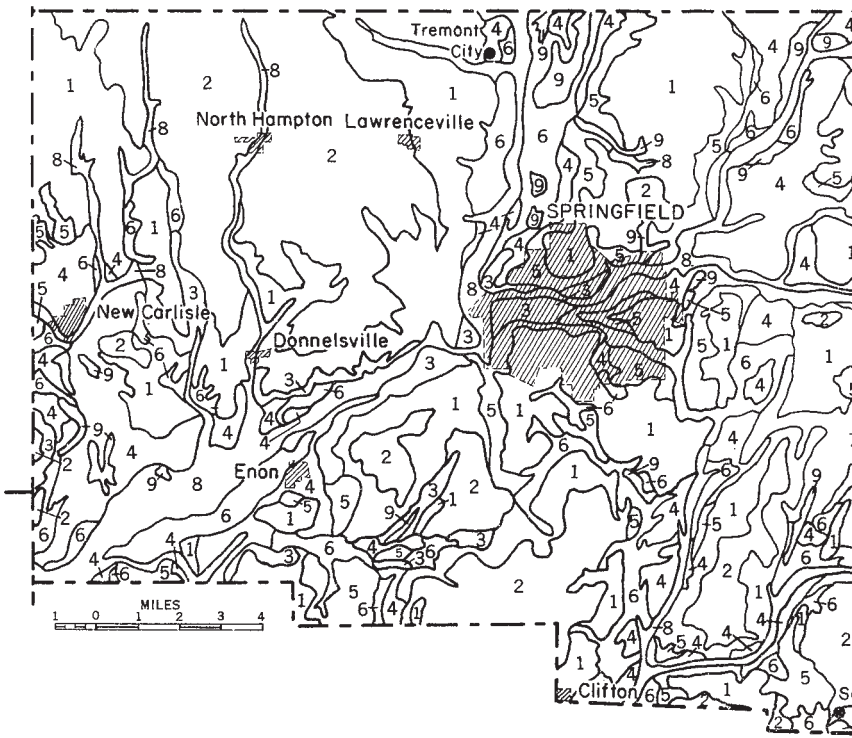

Figure 2.—Soil associations of Clark County

1. Miami-Kendallville-Celina-Crosby.
2. Crosby-Brookston-Celina.
3. Milton-Randolph-Millsdale.
4. Fox-Homer-Warsaw.
5. Bellefontaine-Rodman.
6. Westland-Abington.
7.
8.
9.

2. CROSBY-BROOKSTON-CELINA

Association 2 is made up of the same soils as association 1, but in much different relative proportions. The larger areas of this extensive association coincide with the glacial till plains. The soils are underlain by unassorted calcareous glacial till. Relief is nearly level to undulating. The light-colored, imperfectly drained Crosby and the dark-colored, very poorly drained Brookston are the most extensive soils. There are lesser acreages of moderately well drained undulating Celina soils, and minor areas of Miami, Kendallville, Kokomo, and bottom-land soils. The well-drained Miami and Kendallville soils occur almost entirely on slopes along drainageways. The very poorly drained, dark-colored Kokomo soil occupies level depressions and is closely associated with the Brookston soils.

The Crosby soils predominate in the northwestern part of the county. In the southeastern corner, the Brookston soils are more extensive, and the proportion of Kokomo soil is greater. Elsewhere, the proportionate acreage of the soils varies between these extremes.

Practically all of this association is cleared. The soils are used principally for crops and to a lesser extent for pasture. The uncleared areas consist of small woodlots, mainly on excessively wet areas of the Crosby soils or on the steeper slopes of the Miami and Kendallville soils along drainageways.

Soils of association 2 are extremely important to local agriculture. They produce a large percentage of the corn in the county and support a high proportion of the hogs and beef cattle. They are particularly well suited to corn and grasses, but small grains and legumes are also grown successfully, if adequate drainage is provided. Drainage of the excessively wet areas by tiling has expanded the use suitabilities of these soils so that practically all crops adapted to the region can be grown. Alfalfa, however, is not well suited except under optimum drainage.

Livestock farming, chiefly hog production, is the leading agricultural activity; it is especially important in the southeastern part of the county. Because of the nearly level relief, erosion is not a serious problem. Farm machinery can be used with ease, except when the soils are excessively wet. Management is adequate, or nearly so, although some areas need better drainage. Farms on association 2 soils are among the most prosperous of the county.

3. MILTON-RANDOLPH-MILLSDALE

This inextensive association is composed of soils derived from shallow deposits of calcareous glacial drift over limestone bedrock. The bedrock, which is seldom more than 4 feet below the surface, has contributed at least a part of the soil material. Association 3 occurs in the western part of the county, most commonly in upland positions along streams and drainageways, including the Mad River, Jackson Creek, Honey Creek, and Mud Run. Exceptions are one small terrace area in Springfield and another at the junction of the Mad River and Buck Creek, where the soils were derived from shallow deposits of stratified gravel and sand over limestone bedrock. Relief and drainage vary considerably.

The Milton soils are the most extensive; the Millsdale and Randolph soils follow, in that order. Also included are scattered minor

areas of Steep land-limestone outcrop, Miami soils, and soils of the first bottoms and terraces. The strongly sloping, excessively drained Milton soils (shallow phases) occur almost entirely along the sloping to steep sides of the Mad River gorge, southwest of Springfield. The well-drained Milton soils occupy nearly level to sloping interstream divides, and the imperfectly drained Randolph and very poorly drained Millsdale soils occur in nearly level depressions.

An estimated 75 percent or more of the total area of association 3 is cleared and used for crops or pasture. General farming and dairying are the most important agricultural activities. The Milton soils are largely cultivated or used for pasture. They are well adapted to the common crops of the region, and are especially well suited to alfalfa. Some areas of the Milton soils (shallow phases) and of the Steep land-limestone outcrop land type are forested. The Millsdale and Randolph soils require artificial drainage for optimum production; this is difficult in many places because of the shallow depth to bedrock.

Management varies but is generally not so good as is usual in associations 1 and 2. Pastures, particularly, need better fertilization and weed control.

4. FOX-HOMER-WARSAW

Association 4 is made up of loosely connected bodies of the component soils and occurs on terraces that were formerly glacial valleys. The soils are underlain by stratified calcareous outwash gravel and sand. The deep or moderately deep, light-colored, well-drained Fox soils cover about 80 percent of the area; the poorly drained, deep, light-colored Homer soils about 8 percent; the dark-colored, well-drained, deep Warsaw soils about 5 percent; and the moderately well drained, light-colored, deep Bronson soils about 2 percent. Also included in the association are small scattered patches of dark-colored, very poorly drained Westland, Abington, or Carlisle muck soils, of steep shallow Rodman soils, and of various soils of the bottom lands.

Nearly level to gently undulating relief predominates, but narrow, sloping to steep escarpments occur between the first bottoms and the lowest terraces, between terraces of different levels, or between the highest terraces and the uplands. The slopes are occupied by the Rodman, Fox gravelly loam, or Fox (shallow phase) soils.

Practically all of the nearly level to gently undulating areas made up of Fox, Warsaw, Bronson, and Homer soils are cleared and cultivated. These soils are productive and well suited to the common crops of the region, particularly the winter small grains. The Fox and Warsaw soils are also well suited to alfalfa. Crops having high moisture requirements, such as corn, may not obtain enough moisture from these soils in dry seasons. Erosion is not a problem, and the soils are easily accessible to all farm machinery. Tilth is very good and easily maintained. The Homer soils, and the small areas of Westland, Abington, and Carlisle soils, may need artificial drainage.

Very little of the Fox gravelly loam, eroded sloping shallow phase, and of Rodman soils are in cultivation. Most areas of these soils, where cleared, are used for permanent pasture, the use to which they are best suited.

The agriculture of association 3 is diversified. Livestock raising, principally of hogs, and general farming are the main enterprises.

Farms are among the most prosperous in the county; they are larger than average, and the buildings and fences are generally well built and carefully maintained. Management appears to be of a moderately high quality.

5. BELLEFONTAINE-RODMAN

Association 5 occurs in small and widely scattered areas, largely in the glacial moraines and kames, and to a lesser extent on the kame terraces along the Mad River, Buck Creek, and other streams. The soils were derived from the underlying stratified calcareous gravel and sand. The Bellefontaine soils are the most extensive in the association; Rodman soils occur in smaller acreages, and minor patches of Kendallville, Miami, and terrace and bottom-land soils are included.

Relief ranges from undulating to steep but is predominantly rolling or hilly. In the moraines and kames, the relief is likely to be irregularly sloping and hummocky, but the slopes along drainageways are more uniform. Drainage is good to excessive. The well drained to somewhat excessively drained, moderately deep to deep, light-colored Bellefontaine soils generally are undulating to hilly; the darker colored, shallow, excessively drained Rodman soils typically have hilly to steep relief.

An estimated 75 to 85 percent of the land is cleared and used for pasture or crops. Most of the woodland is on steep Rodman soils that, when cleared, are used for pasture and seldom if ever are cultivated. The undulating and rolling phases of the Bellefontaine soil provide most of the cropland in this association. The steeper areas of Bellefontaine are used principally for pasture.

The agriculture of the association is somewhat diversified, but it centers on dairying and general farming. The Bellefontaine soils, except those on the more hilly and eroded areas, are moderately well suited to most of the common crops and are especially well suited to alfalfa. They are less suited to corn because of their limited water-supplying capacity in dry seasons. The Rodman soils are wholly unsuited to crops and are best used for pasture or forest. As a whole, the soils of this association have rather rapid runoff, are subject to erosion, and have fair to poor accessibility to farm machinery. Erosion control in cultivated areas is the major management problem.

6. WESTLAND-ABINGTON

Association 6 occurs principally in the upper part of the valley of the Mad River. The areas are typically long and narrow and have small drainageways following their long axes. They are somewhat intermixed on the landscape with areas of soil association 4. The soil pattern is fairly uniform. The Westland soils occupy almost level wide depressions, and the level, darker colored Abington soils occur in narrower, deeper depressions, mostly along ditches or drainageways. Both Westland and Abington soils are dark colored and very poorly drained and were derived from stratified calcareous sand and gravel of the glacial outwash valleys. Also included in the association are small, scattered areas of Carlisle muck, of Fox and Homer soils, and of various soils of the bottom lands. Relief is almost level, and the elevation generally is lower than that of the better drained soils of association 4.

Practically all of this association is cleared and used for crops. The original vegetation on the Westland soils was largely swamp forest, but the Abington soils were probably once partly covered by wet-prairie grasses. Without artificial drainage, association 6 areas are swampy. When drained, the soils are exceptionally well suited to corn, soybeans, and grasses. They are less well suited to legumes and winter small grains, which are likely to be damaged by heaving and winterkilling. All small grains tend to lodge on these soils. Alfalfa is not well suited, except under optimum drainage.

Livestock raising is the dominant form of agriculture. Association 6 is exceptionally well suited to livestock farming because the soils are highly productive when planted to corn, grasses, and some kinds of clover. Hogs are the principal livestock, but beef cattle are increasing.

The soils of this association are fine textured and difficult to work. Exacting care is required to maintain tilth. Nevertheless, they are probably the best soils in the county for corn and soybeans and among the best for pasture grasses. Erosion is not a serious problem. Accessibility to farm machinery is excellent, except when the soils are excessively wet.

Apparently agriculture did not develop in this association as rapidly as in others, and these soils were among the last to be drained adequately. Farm tenancy, once higher than average, especially in the upper Mad River valley, has declined since drainage was improved by dredging and relocating the river. In general, the buildings in these areas appear to be newer, smaller, and not so well constructed as in other parts of the county.

7. MAHALASVILLE-MILL CREEK-NEEDHAM

Association 7 occupies glacial outwash valleys. The underlying material is more poorly assorted than that of associations 4 and 6. Most of the Mill Creek soils were derived from poorly assorted calcareous gravel and sand, but a significant part of them and all of the Mahalasville and Needham soils and the included Homer and Bronson soils were derived from and are underlain by calcareous silts, fine sands, and some small pebbles. This material, in turn, usually is underlain, at depths of 4 feet or more, by calcareous gravel and sand. In addition to the Homer and Bronson soils, the association includes small areas of bottom-land soils. It is estimated that the Mahalasville soils occupy about 32 percent of the area, the Mill Creek soils about 30 percent, the Needham soils about 20 percent, the Homer soils about 12 percent, and the Bronson soils about 6 percent. The association is not extensive.

Relief is predominantly level, except that some of the Mill Creek soils are gently undulating. Surface runoff is generally slow, and the soils are uneroded or only slightly sheet eroded. Internal drainage, however, ranges from medium to very slow. Largely because of these differences in drainage, the soils vary considerably in character, agricultural suitability, productivity, and management requirements.

Practically all of association 7 is cleared and used for crops. Agriculture is somewhat diversified, but livestock raising is the principal

type of farming. Dairying and general farming follow. Management appears to be fairly good. The improvement most needed is better drainage of the poorly drained Mahalasville and very poorly drained Needham soils. Draining these soils by tiling is more difficult than draining the similar Westland and Abington soils, because their subsoils are compact and slowly permeable.

8. SLOAN-WABASH-GENESEE-EEL

This is an inextensive association of soils of the bottom lands. It occurs in long, narrow bodies, along the principal streams of the county, chiefly the Mad River, Buck Creek, and the Little Miami River. The poorly drained, dark-colored Sloan soils form about 30 percent of the association; the darker colored, very poorly drained Wabash soils about 29 percent; the lighter colored, well-drained Genesee soils about 21 percent; the moderately well drained, light-colored Eel soils about 10 percent; and the dark-colored, well-drained Ross soils about 8 percent. The rest consists largely of Shoals, Carlisle, Algiers, or Warners soils. Relief is level or nearly level; consequently, runoff is very slow. All the soils, however, are subject to periodic flooding by stream overflow.

Association 8 soils are among the best in supply of plant nutrients and lime. They are not subject to erosion and are easily accessible to farm machinery. Differences among the soils are caused chiefly by differences in internal drainage and in texture of the parent materials. The Sloan, Wabash, and Shoals soils are, to a large extent, artificially drained by tile systems and open ditches. Some, however, are in need of further improvement in drainage.

Probably more than 95 percent of association 8 is cleared and used for crops or pasture. The soils are exceptionally well suited to corn, grasses, and most legumes. They are suited to alfalfa only when adequately drained. Small grains tend to lodge on these soils and are also likely to be damaged by floods. Yields of corn and pasture plants are high, and very little fertilizer is needed for continued high production. Agriculture is somewhat diversified, but a cash grain-general type of farming is the most common. Management, in general, appears to be good.

9. CARLISLE-WARNERS

This very inextensive association consists of small bodies of dark-colored, very poorly drained Carlisle and Warners soils scattered throughout the glacial outwash valleys. The Carlisle soils are underlain by gravel and sand, and the Warners soil by marl or travertine over gravel and sand. These are organic soils having muck or mucky surface layers. Usually they are surrounded by Westland or Abington soils. The Carlisle soils constitute more than 95 percent of the association. In addition to the Warners soil, the association includes small patches of Westland, Abington, and Wabash soils.

Practically all of association 9 has been cleared of its original bog type of vegetation. It is used chiefly for pasture; very little is cultivated. Although artificially drained by tiling and ditching, most of the acreage needs more adequate drainage to make it suitable for either crops or good pasture. Improving the drainage is difficult because of the depressed relief and the lack of outlets. If drained, the

soils could be made suitable for onions, celery, and other truck crops. Better management practices than are common at present would have to be used to establish a profitable agriculture on this association.

MORPHOLOGY, GENESIS, AND CLASSIFICATION OF SOILS

FACTORS OF SOIL FORMATION

The characteristics of the soil at any given place depend upon (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material accumulated and has since existed, (3) the plant and animal life in and on the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material. The interaction of the five factors is so complex that it is difficult to isolate the effects of any one.

Climate and vegetation are the active factors that change a heterogeneous mass of parent material into soil that has a definite genetic morphology. The stage of development depends on the rate at which the forces of climate and vegetation act, and on the length of time these forces have been at work. The action of climate and vegetation is modified by the effects of relief on drainage, erosion, translocation of soil materials, and on the accumulation, decomposition, and removal of organic matter.

PARENT MATERIAL

Glacial drift of the Late Wisconsin period formed the parent material of all the soils of Clark County, except in small scattered areas in the western half of the county. The materials are in five broad classes: (1) unassorted calcareous glacial till; (2) relatively thin deposits of calcareous glacial drift over limestone or dolomitic bedrock; (3) calcareous materials transported and deposited by glacial waters; (4) organic materials derived from the decomposition of plant remains in bogs and marshes; and (5) postglacial deposits of fine-textured materials washed from uplands and terraces and deposited on the flood plains of the present streams.

The glacial till is composed of clays, silts, sands, pebbles, and boulders, mixed in varying proportions and laid down by the glacier in ground moraines, moraines, or kames. Generally, it has a heavy loam or light clay loam texture. Materials deposited by glacial waters consist of (1) highly assorted (stratified) gravel and sand outwash, in the glacial valleys; (2) stratified silts and fine sands, locally containing lenses of clay and gravel, deposited in some glacial valleys; and (3) more or less stratified gravel and sand, deposited as glacial moraines, kames, or kame terraces.

Differences among parent materials account for many of the variations among the soils of the county.

CLIMATE

Clark County has a humid, midcontinental climate. The average annual rainfall is about 38 inches, and the average annual temperature is about 53° F. Summers are moderately long, warm, and humid, and

winters are moderately cold. The rate of evaporation is rather low. Rainfall is well distributed throughout the year but is slightly greater in spring and summer than in fall and winter. All the soils are at least slightly moist most of the year. Leaching is active on the zonal soils during most of the year, and has removed the calcium and magnesium carbonates that are important constituents of the parent material. The climate is uniform throughout the county and does not account for the differences among the zonal soils.

VEGETATION

Originally, most of the county was covered by a dense forest of hardwoods, interspersed with scattered areas of prairie or savanna. The species of trees and density of stands varied considerably on different soils, but it is doubtful that any of the marked differences among the forest-developed soils can be attributed to differences in forest species.

AGE

The effects of time on soil formation are measured by soil profile development. However, the stage of development does not always correlate directly with the geological age of the soil parent material. The modifying effects of other soil-forming factors, particularly relief and parent material, may dominate over age. Shallow soils on steep slopes, for example, are replenished through the weathering of their parent material; but at the same time their surface materials are being removed by geologic erosion, so there is little likelihood that a mature profile will develop. Morphologically, such soils are young, although geologically the soil material may be very old. The modal alluvial soils (see table 6) are youthful both geologically and morphologically. The upland and terrace soils of Clark County, although differing in profile characteristics, were all derived from parent materials of identical geological age. Hence, it is not possible to evaluate the effects of time on these soils.

RELIEF

Relief, more than any other single factor of soil formation, accounts for differences among the soils of Clark County. Relief ranges from level to steep but is predominantly undulating.

The well-drained mature soils of the county, which have reddish-brown, brown, or yellowish-brown uniformly colored B horizons, occur mostly on undulating to rolling relief where drainage is good. The shallow soils with little or no subsoil development usually occur on hilly to steep relief where the drainage is excessive. The light-colored soils, which have mottled yellow and gray B horizons, generally occupy nearly level to gently undulating areas where the drainage is poor. The dark-colored mineral soils with predominantly gray subsurface layers occupy flat or depressed areas where the drainage is very poor.

These relationships between drainage and profile characteristics generally hold true only if the parent materials are moderately permeable. For example, many areas of well-drained Fox soils are nearly level. They owe their good drainage to the extreme permeability of their parent material, not to their relief. It is largely

because of the modifying effects of relief that several different soils may develop from identical parent material under similar conditions of climate, vegetation, and age.

CLASSIFICATION OF SOILS

Soil series are grouped into broader categories, known as great soil groups. The placement of series in great soil groups and some information on the characteristics of each series are given in table 6. Soils occurring on a horizontal line in the table form a catena. A catena is a group of soils that developed on similar parent material under different conditions of natural drainage. Differences among the soils of a given catena have been caused largely by differences in their natural drainage.

GRAY-BROWN PODZOLIC SOILS

The Gray-Brown Podzolic great soil group consists of soils that have developed under deciduous forest in a humid climate. The soils have comparatively thin organic coverings and organic-mineral layers that overlie yellowish-brown, brown, or reddish-brown illuviated layers. These soils differ mainly because of differences in parent material and relief.

Gray-Brown Podzolic soils (well drained).—This group is made up of the Miami, Kendallville, Bellefontaine, Milton, and Wawaka soils of the uplands and the Fox and Mill Creek soils of the terraces. These soils were developed under similar conditions of climate, vegetation, drainage, and age. They are well drained and have well-developed profiles. Although they range from nearly level to steep, their differences may be attributed mostly to differences in parent material, not to variations in slope.

Soils of this group, in their virgin condition, have a thin surface covering of forest litter; a thin, dark, mildly acid or neutral humus, somewhat mixed with mineral soil material of the A_0 horizon; a grayish or yellowish-brown A_1 horizon; a light grayish-yellow or yellowish-brown A_2 horizon; and a B horizon of medium to fine subangular blocky structure. The A_1 and A_2, or eluvial, horizons are lighter colored and coarser textured, higher in silica, and lower in sesquioxides than the B horizons. The A and B horizons have been leached of soluble bases and are acid in reaction. However, the thin surface covering, or A_0 horizon, is high in organic matter and soluble bases, particularly calcium. It is high in these bases because decaying leaves and other organic materials are present. The illuvial, or B, horizons are finer textured because of the accumulated clay, and they also show some accumulation of sesquioxides and colloidal materials at the expense of the A horizons. The C horizons usually contain free carbonates, calcium, and magnesium and are alkaline in reaction. They contain lower percentages of clay and colloidal materials than do the B horizons.

The Miami soils are the most extensive and representative of the Gray-Brown Podzolic soils of the county. They have well developed A, B, and C horizons. The parent material has weathered from calcareous Wisconsin glacial till, and the relief has a dominant gradient of 2 to 10 percent.

386373—58——9

TABLE 6.—*Key to the soils*

Soil characteristics	Gray-Brown Podzolic soils			
Relief	Nearly level to hilly.	Nearly level to hilly.	Nearly level to undulating.	Nearly level to gently undulating.
Drainage	Good to somewhat excessive.	Good	Moderately good.	Imperfect
Soils of the uplands:				
Parent or underlying material:				
Highly calcareous loam to clay loam till.		Miami	Celina	Crosby
Highly calcareous loam to clay loam till underlain by sand and gravel at 3 to 5 feet.		Wawaka		
Highly calcareous moderately coarse drift.		Kendallville.		
Highly calcareous gravel and sand	Bellefontaine.			
Highly calcareous medium-textured drift, 18 to 40 inches deep over limestone.		Milton		Randolph
Soils of the glaciofluvial outwash plains and terraces:				
Parent or underlying material:				
Highly calcareous stratified gravel and sand.	Fox		Bronson	Homer
Highly calcareous poorly assorted gravelly and sandy material.		Mill Creek		
Calcareous sands and silts, together with minor amounts of clay and gravel.				
Soils of the flood plains:				
Parent or underlying material:				
Silts and clays of recent alluvium (neutral or alkaline).				
Stratified silty, clayey and sandy alluvium (neutral to alkaline).				
Light-colored medium-textured alluvium over dark-colored alluvium.				
Organic soils:				
Parent or underlying material:				
Peaty and mucky material, largely from trees, together with some reed and sedge material.				
Thin deposits of muck over gray marl				

The following profile description typical of Miami silt loam, undulating phase, was taken of a virgin area on a 4-percent slope under a forest cover of deciduous trees (SE¼sec. 1, T. 4, R. 9):

A_0 A shallow covering of forest litter and leaf mold.

A_1 0 to 2 inches, dark grayish-brown (10YR 3/2),[7] smooth, friable silt loam; weak granular structure; pH 7.0.[8]

A_2 2 to 7 inches, light yellowish-brown (10YR 5/4), smooth, friable silt loam; moderate medium granular structure; pH 6.5.

A_3
or
B_1 7 to 12 inches, yellowish-brown (10YR 5/4) heavy silt loam or light silty clay loam; friable when moist; moderate medium subangular blocky structure; contains a few scattered small glacial pebbles of granite, quartzite, or other rocks; pH 5.0.

B_{21} 12 to 18 inches, brown (10YR 4/3) clay loam or silty clay loam; firm when moist and moderately plastic when wet; strong medium subangular blocky structure; contains a few scattered glacial pebbles; pH 5.0.

[7] Soil color designations are those shown in the Munsell color charts used by Soil Survey. Moist conditions are given unless otherwise stated.

[8] For definition of soil reaction designations see footnote 9, p. 138. Soil Survey Methods and Definitions.

of Clark County, Ohio

Brunizem (Prairie) soils	Humic Gley soils		Humic Gley soils, intergrading to Alluvial	Rendzina soils	Alluvial soils			Organic soils
Nearly level to gently undulating.	Nearly level.	Nearly level.	Nearly level	Sloping to steep.	Nearly level.	Nearly level.	Nearly level.	Nearly level.
Good to somewhat excessive.	Very poor.	Very poor.	Poor	Excessive	Good	Moderately good.	Imperfect.	Very poor.
	Kokomo	Brookston.						
				Rodman				
	Millsdale.							
Warsaw	Abington.	Westland		Rodman				
	Needham.	Mahalasville.						
			Wabash					
			Sloan		{Genesee Ross}	Eel	Shoals	
							Algiers	
								Carlisle.
								Warners

B_{22} 18 to 24 inches, brown to dark-brown (10YR 4/3) heavy clay loam; very firm when moist and plastic when wet; moderate subangular blocky structure; contains a few glacial pebbles; pH 5.8.

C_1 24 inches +, dark yellowish-brown (10YR 4/4) and light yellowish-brown (2.5Y 6/4) loam glacial till of Wisconsin age; firm when moist; calcareous.

The Wawaka soils have profile characteristics similar to the Miami soils but are underlain by stratified gravel and sand at depths of 3 to about 5 feet.

Kendallville soils have sola developed in outwash containing considerable gravel similar to that in the Fox soils but are underlain by calcareous till. They have developed on thin deposits of outwash over till.

Milton soils, which developed from thin deposits of glacial drift overlying limestone bedrock, have plastic, sticky, brown or reddish-brown lower B horizons. Bedrock occurs at depths ranging from 30 to 44 inches. The shallow phases of Milton silt loam have thinner sola than the typical Milton silt loam, and the lower part is derived partially from limestone.

The Fox and Bellefontaine soils have developed on medium textured outwash material overlying stratified calcareous gravel and sand. The B_{22} and B_{23} horizons contain more gravel than do the respective horizons in the Miami, and the B_{23} horizon is darker colored than in the Miami. Fox soils occur on outwash plains and valley trains; in contrast, the Bellefontaine soils occur on moraines and kames. Fox gravelly loam and the shallow phases of Fox silt loam have thinner sola than do the typical Fox soils. The gravel and sand underlying the Bellefontaine soils is less well assorted in some areas than that underlying the Fox soils.

The Mill Creek soils have developed from medium textured outwash overlying poorly assorted gravel and sand. The sola are usually thicker than the sola of the Fox.

Gray-Brown Podzolic soils (moderately well drained).—This group includes the Celina soils of the uplands and the Bronson soils of the terraces. These soils have profiles similar to those of the well-drained Gray-Brown Podzolic soils but generally have smoother slopes. The B_2 and lower horizons are yellowish-brown, mottled with grayish brown and gray. In comparison with the soils of the Intergrade to Planosols group, they have better internal and external drainage and their A horizons are more uniformly colored and less eluviated.

Celina silt loam, which developed from Wisconsin calcareous till, is the most extensive and is considered most typical of the moderately well drained Gray Brown Podzolic soils in Clark County. The following describes a profile of Celina silt loam, undulating phase, taken on a slope of about 3 percent under vegetation consisting of deciduous trees, mainly white oak, hickory, and black walnut (NW¼ sec. 36, T. 5, R. 8):

A_0 ½ to 0 inches, forest litter and leaf mold.
A_1 0 to 2 inches, dark grayish-brown (10YR 3/2) friable, smooth silt loam; moderate medium granular structure; pH 6.5.
A_2 2 to 9 inches, yellowish-brown (10YR 5/4), friable silt loam; moderate coarse granular structure; pH 6.5.
B_1 9 to 12 inches, yellowish-brown (10YR 5/4) heavy silt loam to silty clay loam; moderate medium to fine subangular blocky structure; friable to firm when moist; pH 6.3.
B_{21} 12 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam, faintly mottled with grayish brown (2.5Y 5/2) in lower part; firm when moist and plastic when wet; moderate to strong medium subangular blocky structure; pH 5.4.
B_{22} 20 to 28 inches, dark yellowish-brown (10YR 4/4) heavy clay loam, mottled with yellowish-brown (10YR 5/6) and gray (10YR 5/1); very firm when moist and plastic and sticky when wet; moderate coarse subangular blocky structure; contains a few partially weathered glacial pebbles; pH 6.4.
C_1 28 inches +, calcareous loam glacial till of Wisconsin age; pH 8.1.

The Bronson soil has developed on medium-textured outwash overlying calcareous stratified gravel and sand of the glacial outwash terraces. The solum is similar to that of the Celina soil but has more gravel in the lower subsoil horizons.

Gray-Brown Podzolic soils (imperfectly drained).—Crosby, Homer, and Randolph soils make up this group. These soils have light-colored, leached, eluviated surface layers underlain by mottled grayish and yellowish-brown, illuviated subsoil layers. They have developed under a beech-maple cover. Because of their nearly level to gently undulating relief, natural erosion is slight and surface runoff is very

slow. Percolation of water through the solum is slow and seasonally sporadic, but the amount is proportionately greater than in the well drained Gray-Brown Podzolic soils. This percolation has resulted in greater depth of carbonate leaching and more translocation of materials by eluviation and illuviation. When the water table was high, the excessive moisture restricted aeration and reduced the iron in the soil to soluble form so that it caused mottling, particularly in the B horizons.

A thin, dark, organic-rich surface layer is present in undisturbed areas, but this soon disappears with cultivation.

Following is a profile typical of uncultivated Crosby silt loam, nearly level phase, on a 1 percent gradient under a cover of deciduous trees, mainly sugar maple, white oak, shagbark hickory, and beech (NE¼sec. 5, T. 3, R. 10):

- A_0 ½ to 0 inches, forest litter and leaf mold.
- A_1 0 to 2 inches, very dark grayish-brown (10YR 4/2) friable silt loam; moderate medium to coarse granular structure; pH 6.0.
- A_2 2 to 7 inches, grayish-brown (10YR 5/2) friable silt loam; moderate coarse granular structure; pH 5.7.
- A_3 7 to 11 inches, mottled olive-brown (2.5Y 4/4) and light brownish-gray (2.5Y 6/2) fine silt loam; friable to firm when moist and hard when dry; strong medium subangular blocky structure; contains occasional small iron concretions; pH 5.4.
- B_1 11 to 17 inches, dark yellowish-brown (10YR 4/4) clay loam mottled with very dark grayish-brown (2.5Y 3/2) and light brownish-gray (10YR 6/2); hard when dry, firm when moist, and plastic when wet; moderate medium subangular blocky structure; contains many small dark iron concretions; pH 5.4.
- B_{21} 17 to 25 inches, mottled yellowish-brown (10YR 5/6), very dark grayish-brown (2.5Y 3/2), and light brownish-gray (10YR 6/2) heavy clay loam; firm when moist, hard when dry, and plastic when wet; moderate coarse subangular blocky structure; contains many small, dark, iron concretions and considerable number of sand grains; pH 5.9.
- B_{22} 25 to 33 inches, yellowish-brown (10YR 5/6) heavy clay loam or silty clay loam mottled with light olive brown (2.5Y 5/4) and light brownish gray (10YR 6/2); very firm when moist, very hard when dry, and plastic when wet; moderate coarse subangular blocky structure; contains many small, dark, iron concretions; pH 6.5.
- C_1 33 inches+, light yellowish-brown (10YR 6/4) calcareous loam to coarse clay loam glacial till mottled with light brownish gray (2.5Y 6/2); pH 8.5.

Homer silt loam occurs on glaciofluvial outwash plains and terraces. It has developed on medium textured outwash overlying stratified gravel and sand. The Homer soil differs from the Crosby in having a thicker solum, a larger amount of grit and pebbles in the B horizons, a gravelly clay loam B_2 horizon, and a D horizon of gravel and sand.

Randolph silt loam resembles the Crosby soil but it has, in addition, a plastic B_3 horizon that overlies limestone bedrock, not till, at depths of 30 to 42 inches.

BRUNIZEM (PRAIRIE) SOILS

The Brunizem group is represented in Clark County by the Warsaw series. Warsaw soils have developed from materials similar to the Fox soils, but their surface horizons are darker colored and contain more organic matter, and they lack A_2 horizons. They are underlain by calcareous, stratified gravel and sand and occur on valley trains and outwash plains.

The following describes a profile typical of Warsaw silt loam, nearly level phase, on a 1 percent slope in a cultivated area (NW¼sec. 10, T. 5, R. 9):

A_p 0 to 8 inches, very dark-brown (10YR 2/2) friable, smooth silt loam; weak medium granular structure; relatively high organic-matter content; pH 6.0.

A_{12} 8 to 15 inches, black (10YR 2/1) when wet, and very dark-brown (10YR 2/2) when barely moist, smooth, friable, silt loam; moderate medium granular structure; fairly high in organic matter; pH 5.3.

A_3 or B_1 15 to 20 inches, dark-brown (10YR 4/3) smooth, friable, heavy silt loam; moderate coarse granular structure; aggregates coated with thin, very dark-brown (10YR 2/2) films; pH 5.3.

B_{21} 20 to 36 inches, brown (10YR 5/3) silty clay loam; slightly plastic when wet and firm when moist; moderate medium subangular blocky structure; pH 5.2.

B_{22} 36 to 43 inches, dark reddish-brown (5YR 3/4) sandy clay loam; plastic and slightly sticky when wet and firm when moist; moderate coarse subangular blocky structure; contains a few pebbles; pH 5.3.

B_{23} 43 to 51 inches, brown (7.5YR 5/4) to dark-brown (7.5YR 4/2) fine gravelly clay loam; slightly plastic and sticky when wet and firm when moist; weak very coarse blocky structure; pH 5.9.

D 51 inches +, stratified coarse sand and medium gravel, high in limestone and dolomite; pH 8.2.

HUMIC GLEY SOILS

The Humic Gley group consists of very poorly drained soils that have thick dark-colored, organic-mineral horizons underlain by mineral gley layers. They developed under either swamp forest or herbaceous marsh vegetation, mostly in humid and submumid climates of widely varying thermal efficiency.

This group includes the Brookston, Kokomo, Westland, Abington, Mahalasville, Needham, and Millsdale soils. They have developed in broad depressed flats or in depressional areas under very poor natural drainage conditions. Runoff or seepage water from the adjacent higher areas accumulates on areas of these soils, and under natural conditions the water table was at or near the surface for a considerable part of each year. This resulted in the reduction of iron compounds, and as a result the subsoils are light gray, gray, or mottled gray and brownish or yellowish.

The Humic-Gley soils are neutral or only slightly acid in the sola. Dissolved bases, principally calcium, has been retained, and the accumulation of organic matter in the surface horizons has also added to the supply of bases. The exchange capacity is also higher than in the associated Gray-Brown Podzolic soils.

The Abington soils are representative of the Humic-Gley group. The following is a profile description of Abington silty clay loam taken in a nearly level cultivated area (NW¼sec. 31, T. 4, R. 10):

A_p 0 to 7 inches, black, (10YR 2/1) silty clay loam; friable; moderate coarse granular structure; high organic-matter content; pH 7+.

A_{12} 7 to 13 inches, black (10YR 2/1) silty clay loam, with scattered streaks of brown (7.5YR 5/6); slightly plastic when wet and firm when moist; moderate fine and medium subangular blocky structure; contains some pebbles; high in organic matter; pH 7+.

A_{13} 13 to 22 inches, very dark-gray (7.5YR 3/0) silty clay loam, with strong brown (7.5YR 5/6) along old root channels; plastic when wet and firm when moist; moderate coarse subangular blocky or weak prismatic structure; contains a few small gravel and sand particles; relatively high in organic matter; pH 7+.

B_{21g} 22 to 36 inches, gray (10YR 5/1) sandy and gravelly clay loam very slightly mottled with yellowish brown (10YR 5/6); very plastic when wet and very firm when moist; moderate very coarse angular blocky structure; contains considerable small pebbles and cobbles; pH 7+.

B_{22g} 36 to 50 inches, light brownish-gray (10YR 5/2) sandy and gravelly clay loam mottled with yellowish brown (10YR 5/6); plastic when wet and very firm when moist; weak very coarse angular blocky structure; pebbles and cobbles increase in number with depth; pH 7+.

D 50 inches +, stratified sand and gravel; pH 8+.

Westland soils have thinner and somewhat lighter colored A_1 horizons that contain less organic matter than the A_1 horizons of Abington soils; the B_{2g} horizons are mottled gray and yellowish or brownish, and calcareous stratified gravel and sand occurs at about the same depth as in the Abington.

Brookston soils have developed from calcareous loam or light clay loam till. Following is a description of Brookston silty clay loam on nearly level relief under a dominant vegetation of elm, white oak, and ash (SE¼sec. 1, T. 4, R. 9):

A_0 ½ to 0 inches, mat of forest litter and leaf mold.

A_{11} 0 to 6 inches, very dark-gray (10YR 3/1) silty clay loam; friable when moist and slightly plastic when wet; moderate medium granular structure; high in organic matter; pH 7.0.

A_{12} 6 to 15 inches, very dark-gray (10YR 3/1) or very dark-brown (10YR 2/2) silty clay loam; slightly plastic when wet and firm when moist; moderate coarse granular structure; high in organic matter; pH 6.6.

B_{21} 15 to 24 inches, yellowish-brown (10YR 5/6) mottled with dark grayish-brown (2.5Y 3/2) and grayish-brown (10YR 5/2) heavy clay loam; plastic and sticky when wet and very firm when moist; moderate medium angular blocky structure; has some organic matter on the ped faces; pH 7.0.

B_{22} 24 to 52 inches, mottled olive-yellow (2.5Y 6/8) and light-gray 10YR 7/2) silty clay loam; yellow color dominates in the lower part; moderate coarse angular blocky structure; contains a few scattered weathered limestone or dolomite pebbles; pH 7.6.

C 52 inches +, mottled yellowish-brown and gray loam or light clay loam calcareous glacial till; pH 7.9.

Kokomo soils have also developed from calcareous loam or light clay loam till, but they differ from Brookston soils in having darker colored and thicker A_1 horizons that are higher in organic content and in having B_{2g} horizons that are dominantly light gray or gray.

The Mahalasville soils have developed from stratified calcareous silts and fine sand in which there are thin lenses of clay and fine gravel. The color, thickness, and organic content of the A_1 horizons are comparable to those of the A_1 horizons of Brookston, and the B_g horizons are mottled.

The Needham soil has also developed from stratified calcareous silts and fine sand but differs from Mahalasville in having thicker A_1 horizons that are darker colored and contain more organic matter and in having B_{2g} horizons that are dominantly gray or light gray.

The Millsdale soil has developed from thin deposits, 30 to 44 inches thick, of fine-textured drift that overlie limestone bedrock.

Humic Gley soils, intergrading to Alluvial soils.—This group of soils includes the Sloan and Wabash soils. Although they occur on alluvial positions, Sloan and Wabash soils have received little or no recent surface deposit. The surface soil is comparable to that of the

Humic Gley soils in color, organic content, and thickness, but there is only slight development of textural B_{2g} horizons, and then as only a few clay skins on the ped faces.

RENDZINA SOILS

This group is represented by the Rodman soils. They have developed from calcareous stratified gravel and sand and are usually sloping to steep. They have very dark-gray surface horizons that are high in organic matter and no B or very thin B horizons. The eroded units have light-colored A_1 or A_p horizons and, in this respect, may intergrade to the Regosols.

ORGANIC SOILS

In the Organic soils group are the various phases of Carlisle muck and Warners loam. The following description of Carlisle muck was taken in a pastured area (SE¼sec. 5, T. 5, R. 10):

A_p 0 to 6 inches, black (7.5YR 2/0) muck; finely divided; very friable; weak fine granular structure; coarser structure in the lower 4 inches; pH 7.5.

C_1 6 to 30 inches, black (7.5YR 2/1) muck; breaks out in fairly large chunks with conchoidal fracture; friable; contains some distinguishable, partly decomposed plant remains (reeds and sedges) that increase in quantity with depth; more fibrous, less compact, and softer in consistence in the lower part; pH 5.6.

C_2 30 to 50 inches +, dark grayish-brown (10YR 4/2) to very dark grayish-brown (10YR 3/2), fibrous, macerated peat; pH 5.4.

Carlisle muck, shallow phase, differs from Carlisle muck principally in having muck, less than 40 inches thick, overlying mineral material.

Warners loam has a 6- to 12-inch surface layer of muck that often contains considerable marl. The muck is underlain by gray marl, or calcareous tuffa or travertine. Although included with the Organic soil group, the Warners is an intergrade to the Regosols.

ALLUVIAL SOILS

Alluvial soils consist of recent deposits of alluvial and colluvial materials transported by water. They are very young, and the original material has been modified only slightly, if at all, by soil-forming forces. Differences among layers are largely the result of differences in drainage, age of material, or vegetation, or of differential deposition of various types of alluvium, or some combination of these factors. All the Alluvial soils in Clark County have originated from alluvium washed from the uplands and terraces underlain by calcareous glacial drift of Wisconsin Age. They range from very slightly acid to alkaline in reaction.

This group includes the well-drained Genesee, well-drained Ross, moderately well drained Eel, the imperfectly drained Shoals, and the imperfectly drained Algiers soils. These soils are subject to flooding and deposition of new soil material.

Following is a profile description of Genesee silt loam observed in a pasture field adjacent to the Mad River (NW¼sec. 16, T. 4, R. 9):

A_{11} 0 to 3 inches, very dark grayish-brown (10YR 3/2) friable silt loam; moderate medium granular structure; pH 7.6.

A_{12} 3 to 13 inches, dark grayish-brown (10YR 4/2) friable silt loam; moderate to weak fine subangular blocky structure; pH 7.8.

C_1 13 to 30 inches, dark grayish-brown (10YR 4/2) friable light silty clay loam; very weak coarse subangular blocky structure; pH 7.8.
C_2 30 to 53 inches, dark grayish-brown (10YR 4/2) friable silt loam; very weak medium subangular blocky structure; more friable and lighter textured than horizon above; pH 7.9.
C_3 53 inches +, dark grayish-brown (2.5Y 4/2), faintly mottled with yellowish-brown (10YR 5/4), stratified light silty clay loam, silt loam, and loam; slightly plastic and sticky when wet and friable when moist; massive; contains numerous snail shells and sand grains; pH 8.0.

The Ross soils have very dark-gray to very dark-brown surface horizons, 14 to 18 inches thick, over light-colored alluvium. There is a slight B horizon development in some areas.

The Eel soil is similar to Genesee to depths of 16 to 24 inches, but below this it is mottled gray and yellowish or brownish.

The Sloan soil is mottled at depths of 6 to 16 inches. The Algiers soil consists of deposits 10 to 30 inches deep of light-colored alluvium that lie over dark-colored alluvium.

SOIL SURVEY METHODS AND DEFINITIONS

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts that he observes, and maps their boundaries on an aerial photograph or other map.

Field study.—The soil surveyor bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern; they are located according to the lay of the land. Usually they are not more than a quarter of a mile apart and sometimes they are much closer. In most soils such a boring or hole reveals several distinct layers, called horizons, which collectively are known as the soil profile. Each layer is studied to see how it differs from others in the profile and to learn the things about this soil that influence its capacity to support plant growth.

Color is usually related to the amount of organic matter. The darker the surface soil, as a rule, the more organic matter it contains. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

Texture, or the content of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers and is later checked by laboratory analysis. Texture determines how well the soil retains moisture, plant nutrients, and fertilizer, and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in larger grains and the amount of pore space between grains, gives us clues to the ease or difficulty with which the soil is penetrated by plant roots and by moisture.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Other characteristics observed in the course of the field study and considered in classifying the soil include the following: The depth of the soil over bedrock or compact layers; the presence of gravel or stones in amounts that will interfere with cultivation; the steepness and pattern of slopes; the degree of erosion; the nature of the underly-

ing parent material from which the soil has developed; and acidity or alkalinity of the soil [9] as measured by chemical tests.

Classification.—On the basis of the characteristics observed by the survey team or determined by laboratory tests, soils are classified into phases, types, and series. The soil type is the basic classification unit. A soil type may consist of several phases. Types that resemble each other in most of their characteristics are grouped into soil series.

As an example of soil classification, consider the Bellefontaine series of Clark County. This series is made up of two soil types, subdivided into phases, as follows:

Series	*Type*	*Phase*
Bellefontaine	Silt loam	Undulating phase.
		Eroded undulating phase.
		Gently rolling phase.
		Eroded gently rolling phase.
		Severely eroded gently rolling phase.
	Loam and silt loam	Rolling phases.
		Eroded rolling phases.
		Severely eroded rolling phases.
		Eroded hilly phases.

Soil type.—Soils similar in kind, thickness, and arrangement of soil layers are classified as one soil type.

Soil phase.—Because of differences other than those of kind, thickness and arrangement of layers, some soil types are divided into two or more phases. Slope variations, frequency of rock outcrops, degree of erosion, depth of soil over the substratum, or natural drainage are examples of characteristics that suggest dividing a soil type into phases.

The soil phase (or the soil type if it has not been subdivided) is the unit shown on the soil map. It is the unit that has the narrowest range of characteristics. Use and management practices therefore can be specified more easily than for soil series or yet broader groups that contain more variation.

Soil series.—Two or more soil types that differ in surface texture, but are otherwise similar in kind, thickness, and arrangement of soil layers, are normally designated as a soil series. In a given area, however, it frequently happens that a soil series is represented by only

[9] Acidity or alkalinity of a soil, as measured by chemical tests, is expressed as the pH value. A pH value of 7 indicates precise neutrality; a higher value indicates alkalinity; and a lower value, acidity. Terms used in this report to indicate degrees of acidity or alkalinity, and their equivalents in pH values, as defined in Soil Survey Manual (*8*), are as follows:

	pH
Extremely acid	Less than 4.5
Very strongly acid	4.5–5.0
Strongly acid	5.1–5.5
Medium acid	5.6–6.0
Slightly acid	6.1–6.5
Neutral	6.6–7.3
Mildly alkaline	7.4–8.0
Strongly alkaline	8.1–9.0
Very strongly alkaline	9.1 and higher

one soil type. Each series is named for a place near which it was first mapped.

Miscellaneous land types.—Areas that have little true soil are not classified into types and series, but are identified by descriptive names, such as Steep land-limestone outcrop.

Soil complex.—When two or more soils are so intricately associated in small areas that it is not feasible to show them separately on the soil map, they are mapped together and called a soil complex. Celina-Crosby silt loams is a soil complex mapped in this county.

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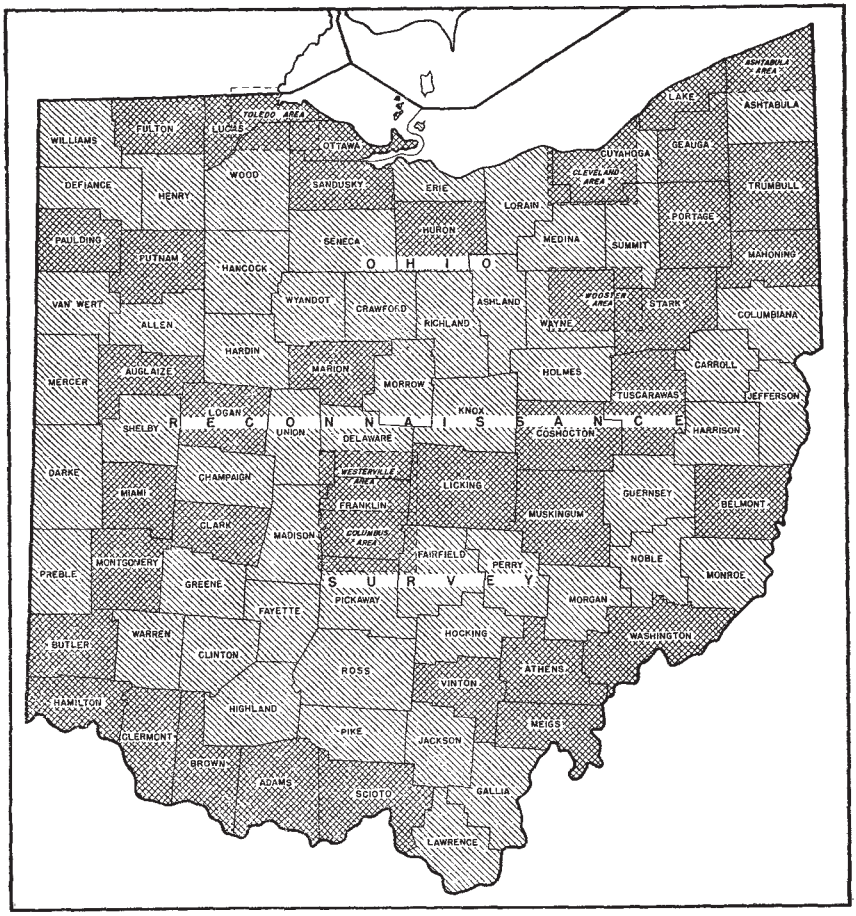

Areas surveyed in Ohio: Reconnaissance surveys shown by northwest-southeast hatching; crosshatching indicates areas covered by both detailed and reconnaissance surveys.

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(3) email: program.intake@usda.gov.

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
CLARK COUNTY–OHIO
SHEET NO. 1

OHIO AGRICULTURAL EXPERIMENT STATION

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads, Trails
- Railroads
- Bridges, Ferry
- Railroad crossings
- Ford, Dam, Sawmill, Windmill
- Boundary lines
- School, Church, Creamery, Cemeteries
- Boundary lines
- Triangulation station, Boundary monument, Oil or Gas wells
- U. S. Township and Section lines, Recovered corners
- Forest fire station, Airway beacon, Oil or Gas tanks
- Transmission line, Oil or Gas pipe line
- Mine or Quarry, Gravel pit, Rock outcrop, Sand Spots
- Soil boundaries; Stony, Gravelly, and Cherty areas

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Prominent hills or Mountain peaks
- Sand, Wash, Sand dunes
- Bluff, Escarpment, Mine dumps

DRAINAGE
(Printed in blue)

- Streams, Springs, Wells, Wet Spots
- Lakes, Ponds, Intermittent lakes
- Swamp, Salt marsh
- Water pipe lines, Canals, Ditches, Flumes
- Intermittent Streams
  Crossable with farm machinery
  Not crossable with farm machinery

ACCELERATED EROSION
Gully, Unclassified

DIAGRAM
Showing arrangement of sheets

J. Kenneth Ableiter, Chief Soil Correlator.
W. H. Allaway, Chief Analyst, Soil Uses and Productivity
Earl D. Fowler, Principal Soil Correlator, Northern States.
Area Inspected by O. C. Rogers, Senior Soil Correlator.
Soils surveyed 1946-48 by J. H. Petro, Bureau of Plant Industry
Soils and Agricultural Engineering, in Charge, Fenton Gray,
W. S. Mozier, and C. J. Fox, Soil Conservation Service, and
O. W. Bidwell, Ohio Agricultural Experiment Station

Scale 1:24,000
1 ½ 0 1 2 Miles
5000 0 5000 10,000 Feet

* U. S. GOVERNMENT PRINTING OFFICE : 1958 O—386373

See Sheet No. 4 for Alphabetical Legend and Color Grouping.

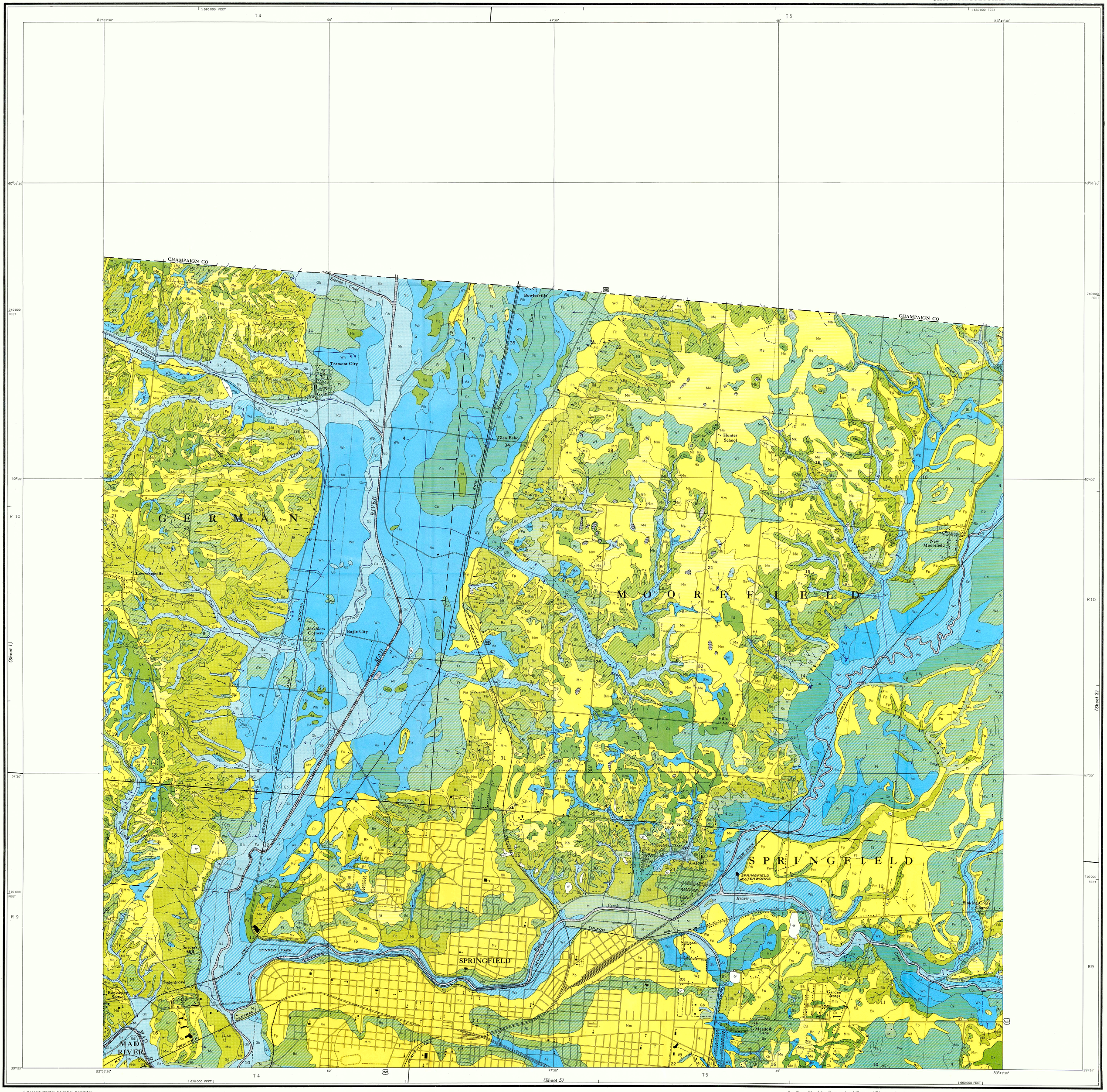
Map constructed by Division of Cartography,
Soil Conservation Service, USDA,
from 1936-38 aerial photographs.
Soils surveyed on 1936-38 aerial photographs.
Polyconic projection, 1927 North American datum.
10 000-foot grid based on Ohio (South)
rectangular coordinate system.

(Sheet 4)
(Sheet 2)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
CLARK COUNTY–OHIO
SHEET NO. 2

OHIO AGRICULTURAL EXPERIMENT STATION



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O. W. Bidwell, Ohio Agricultural Experiment Station

Scale 1:24,000

1 ½ 0 1 2 Miles

5000 0 5000 10 000 Feet

☆ U. S. GOVERNMENT PRINTING OFFICE: 1956 O—386373

See Sheet No. 1 for Conventional Signs and Diagram showing arrangement of sheets.
See Sheet No. 4 for Alphabetical Legend and Color Grouping.

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Polyconic projection, 1927 North American datum.
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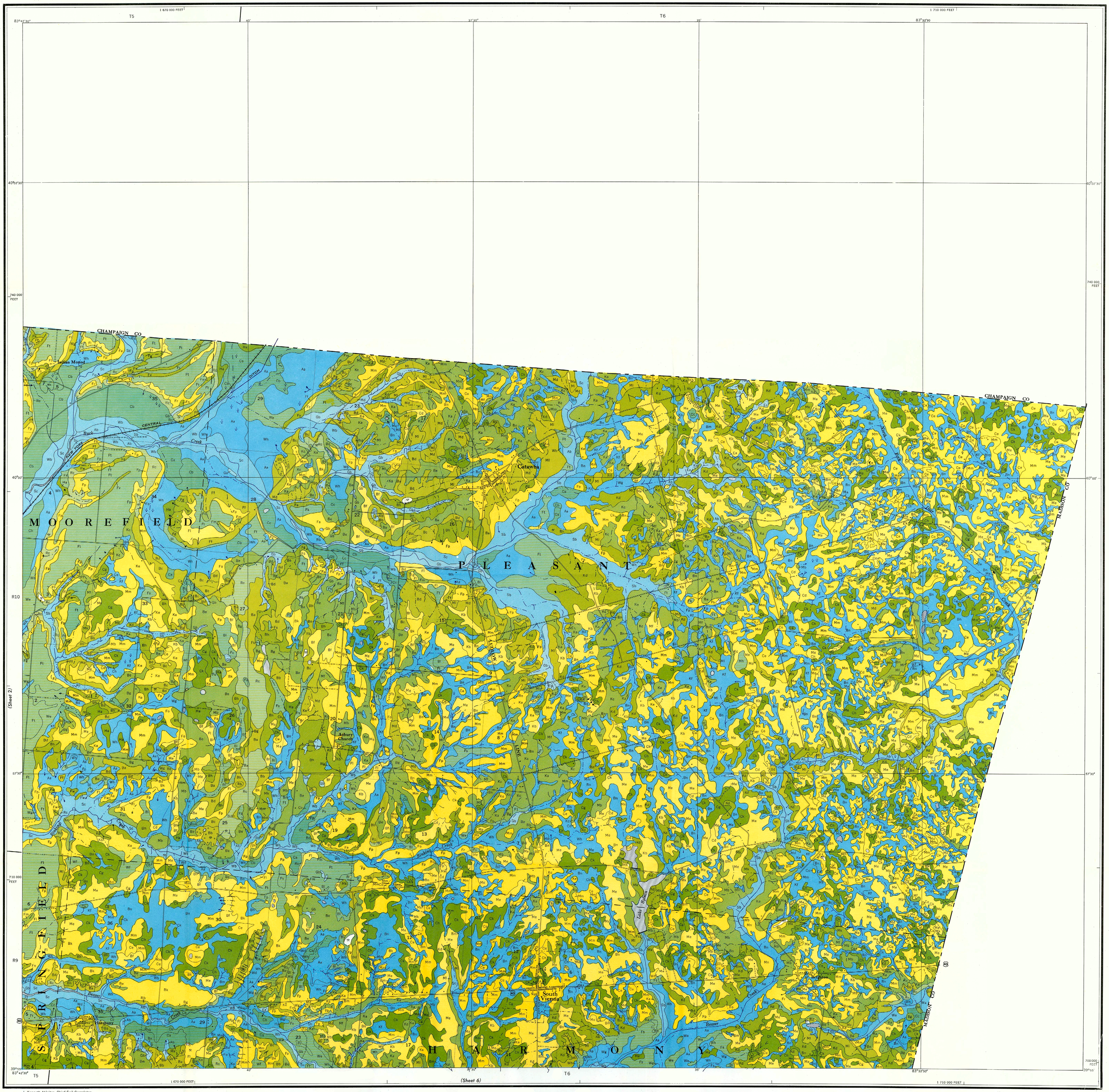
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
CLARK COUNTY–OHIO
SHEET NO. 3

OHIO AGRICULTURAL EXPERIMENT STATION



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Scale 1:24,000

1 ½ 0 1 2 Miles

5000 0 5000 10000 Feet

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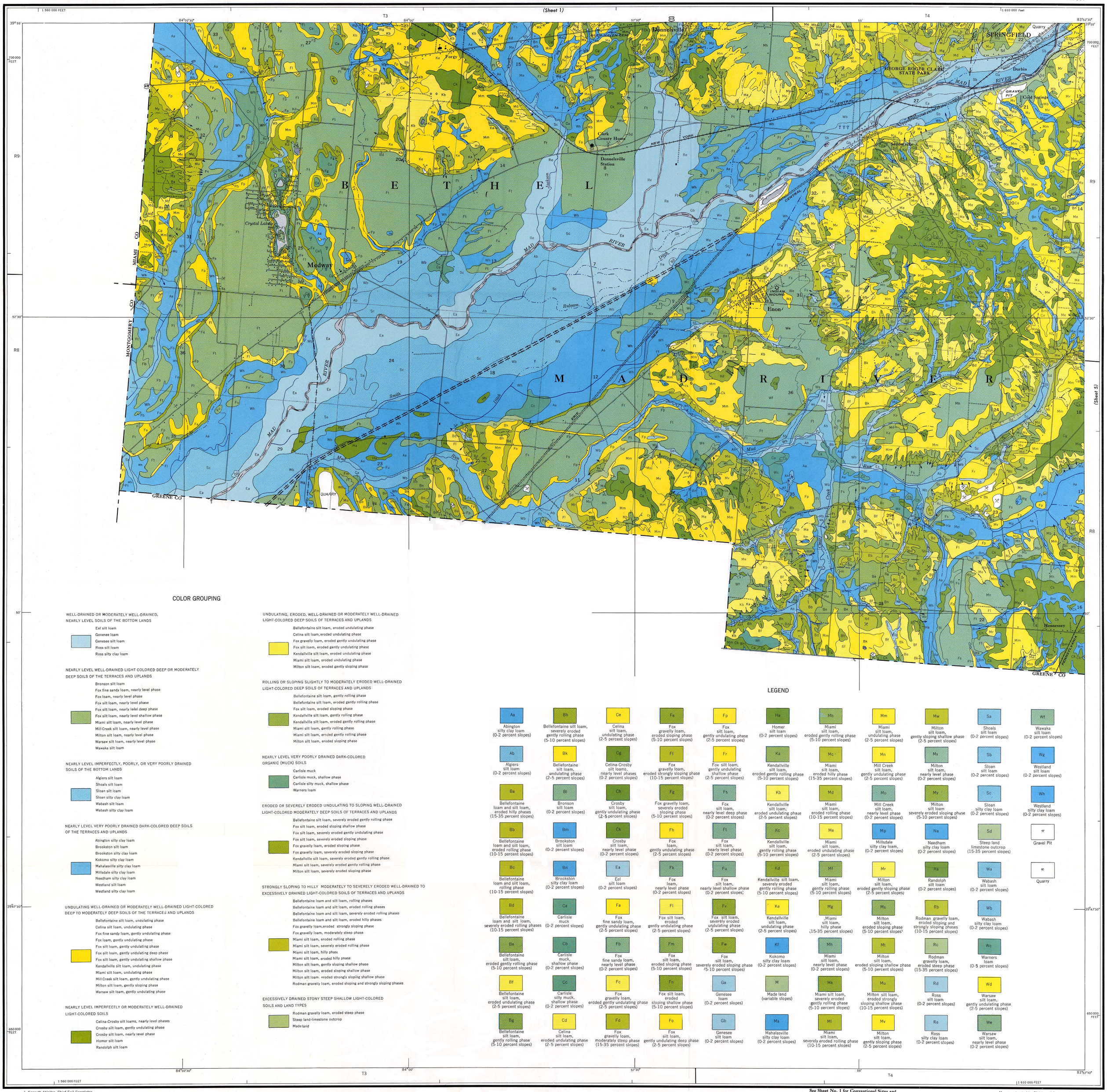
10,000-foot grid based on Ohio (South) rectangular coordinate system.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1956 O—386373

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
CLARK COUNTY–OHIO
SHEET NO. 4

OHIO AGRICULTURAL EXPERIMENT STATION



COLOR GROUPING

WELL-DRAINED OR MODERATELY WELL-DRAINED, NEARLY LEVEL SOILS OF THE BOTTOM LANDS

- Eel silt loam
- Genesee loam
- Genesee silt loam
- Ross silt loam
- Ross silty clay loam

NEARLY LEVEL WELL-DRAINED LIGHT COLORED DEEP OR MODERATELY DEEP SOILS OF THE TERRACES AND UPLANDS

- Bronson silt loam
- Fox fine sandy loam, nearly level phase
- Fox loam, nearly level phase
- Fox silt loam, nearly level phase
- Fox silt loam, nearly level deep phase
- Fox silt loam, nearly level shallow phase
- Miami silt loam, nearly level phase
- Mill Creek silt loam, nearly level phase
- Milton silt loam, nearly level phase
- Warsaw silt loam, nearly level phase
- Wawaka silt loam

NEARLY LEVEL IMPERFECTLY, POORLY, OR VERY POORLY DRAINED SOILS OF THE BOTTOM LANDS

- Algiers silt loam
- Shoals silt loam
- Sloan silt loam
- Sloan silty clay loam
- Wabash silt loam
- Wabash silty clay loam

NEARLY LEVEL VERY POORLY DRAINED DARK-COLORED DEEP SOILS OF THE TERRACES AND UPLANDS

- Abington silty clay loam
- Brookston silt loam
- Brookston silty clay loam
- Kokomo silty clay loam
- Mahalasville silty clay loam
- Millsdale silty clay loam
- Needham silty clay loam
- Westland silt loam
- Westland silty clay loam

UNDULATING WELL-DRAINED OR MODERATELY WELL-DRAINED LIGHT-COLORED DEEP TO MODERATELY DEEP SOILS OF THE TERRACES AND UPLANDS

- Bellefontaine silt loam, undulating phase
- Celina silt loam, undulating phase
- Fox fine sandy loam, gently undulating phase
- Fox loam, gently undulating phase
- Fox silt loam, gently undulating phase
- Fox silt loam, gently undulating deep phase
- Fox silt loam, gently undulating shallow phase
- Kendallville silt loam, undulating phase
- Miami silt loam, undulating phase
- Mill Creek silt loam, gently undulating phase
- Milton silt loam, gently sloping phase
- Warsaw silt loam, gently undulating phase

NEARLY LEVEL IMPERFECTLY OR MODERATELY WELL-DRAINED LIGHT-COLORED SOILS

- Celina-Crosby silt loams, nearly level phases
- Crosby silt loam, gently undulating phase
- Crosby silt loam, nearly level phase
- Homer silt loam
- Randolph silt loam

UNDULATING, ERODED, WELL-DRAINED OR MODERATELY WELL-DRAINED LIGHT-COLORED DEEP SOILS OF TERRACES AND UPLANDS

- Bellefontaine silt loam, eroded undulating phase
- Celina silt loam, eroded undulating phase
- Fox gravelly loam, eroded gently undulating phase
- Fox silt loam, eroded gently undulating phase
- Kendallville silt loam, eroded undulating phase
- Miami silt loam, eroded undulating phase
- Milton silt loam, eroded gently sloping phase

ROLLING OR SLOPING SLIGHTLY TO MODERATELY ERODED WELL-DRAINED LIGHT-COLORED DEEP SOILS OF TERRACES AND UPLANDS

- Bellefontaine silt loam, gently rolling phase
- Bellefontaine silt loam, eroded gently rolling phase
- Fox silt loam, eroded sloping phase
- Kendallville silt loam, gently rolling phase
- Kendallville silt loam, eroded gently rolling phase
- Miami silt loam, gently rolling phase
- Miami silt loam, eroded gently rolling phase
- Milton silt loam, eroded sloping phase

NEARLY LEVEL VERY POORLY DRAINED DARK-COLORED ORGANIC (MUCK) SOILS

- Carlisle muck
- Carlisle muck, shallow phase
- Carlisle silty muck, shallow phase
- Warners loam

ERODED OR SEVERELY ERODED UNDULATING TO SLOPING WELL-DRAINED LIGHT-COLORED MODERATELY DEEP SOILS OF TERRACES AND UPLANDS

- Bellefontaine silt loam, severely eroded gently rolling phase
- Fox silt loam, eroded sloping shallow phase
- Fox silt loam, severely eroded gently undulating phase
- Fox silt loam, severely eroded sloping phase
- Fox gravelly loam, eroded sloping phase
- Fox gravelly loam, severely eroded sloping phase
- Kendallville silt loam, severely eroded gently rolling phase
- Miami silt loam, severely eroded gently rolling phase
- Milton silt loam, severely eroded sloping phase

STRONGLY SLOPING TO HILLY MODERATELY TO SEVERELY ERODED WELL-DRAINED TO EXCESSIVELY DRAINED LIGHT-COLORED SOILS OF TERRACES AND UPLANDS

- Bellefontaine loam and silt loam, rolling phases
- Bellefontaine loam and silt loam, eroded rolling phases
- Bellefontaine loam and silt loam, severely eroded rolling phases
- Bellefontaine loam and silt loam, eroded hilly phases
- Fox gravelly loam, eroded strongly sloping phase
- Fox gravelly loam, moderately steep phase
- Miami silt loam, eroded rolling phase
- Miami silt loam, severely eroded rolling phase
- Miami silt loam, hilly phase
- Miami silt loam, eroded hilly phase
- Milton silt loam, gently sloping shallow phase
- Milton silt loam, eroded sloping shallow phase
- Milton silt loam, eroded strongly sloping shallow phase
- Rodman gravelly loam, eroded sloping and strongly sloping phases

EXCESSIVELY DRAINED STONY STEEP SHALLOW LIGHT-COLORED SOILS AND LAND TYPES

- Rodman gravelly loam, eroded steep phase
- Steep land-limestone outcrop
- Made land

LEGEND

Aa Abington silty clay loam (0-2 percent slopes)	Bh Bellefontaine silt loam, severely eroded gently rolling phase (5-10 percent slopes)	Ce Celina silt loam, undulating phase (2-5 percent slopes)	Fe Fox gravelly loam, eroded sloping phase (5-10 percent slopes)	Fp Fox silt loam, gently undulating phase (2-5 percent slopes)	Ha Homer silt loam (0-2 percent slopes)	Mb Miami silt loam, eroded gently rolling phase (5-10 percent slopes)	Mm Miami silt loam, undulating phase (2-5 percent slopes)	Mw Milton silt loam, gently sloping shallow phase (2-5 percent slopes)	Sa Shoals silt loam (0-2 percent slopes)	Wf Wawaka silt loam (0-2 percent slopes)
Ab Algiers silt loam (0-2 percent slopes)	Bk Bellefontaine silt loams, undulating phase (2-5 percent slopes)	Cg Celina-Crosby silt loams, nearly level phases (0-2 percent slopes)	Ft Fox gravelly loam, eroded strongly sloping phase (10-15 percent slopes)	Fr Fox silt loam, gently undulating shallow phase (2-5 percent slopes)	Ka Kendallville silt loam, eroded gently rolling phase (5-10 percent slopes)	Mc Miami silt loam, eroded hilly phase (15-35 percent slopes)	Mn Mill Creek silt loam, gently undulating phase (2-5 percent slopes)	Mx Milton silt loam, nearly level phase (0-2 percent slopes)	Sb Sloan silt loam (0-2 percent slopes)	Wg Westland silt loam (0-2 percent slopes)
Ba Bellefontaine loam and silt loam, eroded hilly phases (15-35 percent slopes)	Bl Bronson silt loam (0-2 percent slopes)	Ch Crosby silt loams, gently undulating phase (2-5 percent slopes)	Fg Fox gravelly loam, severely eroded sloping phase (5-10 percent slopes)	Fs Fox silt loam, nearly level deep phase (0-2 percent slopes)	Kb Kendallville silt loam, eroded undulating phase (2-5 percent slopes)	Md Miami silt loam, eroded rolling phase (10-15 percent slopes)	Mo Mill Creek silt loam, nearly level phase (0-2 percent slopes)	My Milton silt loam severely eroded sloping phase (5-10 percent slopes)	Sc Sloan silty clay loam (0-2 percent slopes)	Wh Westland silty clay loam (0-2 percent slopes)
Bb Bellefontaine loam and silt loam, eroded rolling phase (10-15 percent slopes)	Bm Brookston silt loam (0-2 percent slopes)	Ck Crosby silt loam, nearly level phase (0-2 percent slopes)	Fh Fox loam, gently undulating phase (2-5 percent slopes)	Ft Fox silt loam, nearly level phase (0-2 percent slopes)	Kc Kendallville silt loam, gently rolling phase (5-10 percent slopes)	Me Miami silt loam, eroded undulating phase (2-5 percent slopes)	Mp Millsdale silty clay loam, (0-2 percent slopes)	Na Needham silty clay loam (0-2 percent slopes)	Sd Steep land limestone outcrop (15-35 percent slopes)	Gravel Pit
Bc Bellefontaine loam and silt loam, rolling phase (10-15 percent slopes)	Bn Brookston silty clay loam (0-2 percent slopes)	Ea Eel silt loam (0-2 percent slopes)	Fk Fox loam, nearly level phase (0-2 percent slopes)	Fu Fox silt loam, nearly level shallow phase (0-2 percent slopes)	Kd Kendallville silt loam, severely eroded gently rolling phase (5-10 percent slopes)	Mf Miami silt loam, gently rolling phase (5-10 percent slopes)	Mr Milton silt loam, eroded gently sloping phase (2-5 percent slopes)	Ra Randolph silt loam (0-2 percent slopes)	Wa Wabash silt loam (0-2 percent slopes)	Quarry
Bd Bellefontaine loam and silt loam, severely eroded rolling phases (10-15 percent slopes)	Ca Carlisle muck (0-2 percent slopes)	Fa Fox fine sandy loam, gently undulating phase (2-5 percent slopes)	Fl Fox silt loam, eroded gently undulating phase (2-5 percent slopes)	Fv Fox silt loam, severely eroded undulating phase (2-5 percent slopes)	Ke Kendallville silt loam, undulating phase (2-5 percent slopes)	Mg Miami silt loam, hilly phase (15-35 percent slopes)	Ms Milton silt loam, eroded sloping phase (5-10 percent slopes)	Rb Rodman gravelly loam, eroded sloping and strongly sloping phases (10-15 percent slopes)	Wb Wabash silty clay loam (0-2 percent slopes)	
Be Bellefontaine silt loam, eroded gently rolling phase (5-10 percent slopes)	Cb Carlisle muck, shallow phase (0-2 percent slopes)	Fb Fox fine sandy loam, nearly level phase (0-2 percent slopes)	Fm Fox silt loam, eroded sloping phase (5-10 percent slopes)	Fw Fox silt loam, severely eroded sloping phase (5-10 percent slopes)	Kf Kokomo silty clay loam (0-2 percent slopes)	Mh Miami silt loam, nearly level phase (0-2 percent slopes)	Mt Milton silt loam, eroded sloping shallow phase (5-10 percent slopes)	Rc Rodman gravelly loam, eroded steep phase (15-35 percent slopes)	Wc Warners loam (0-5 percent slopes)	
Bf Bellefontaine silt loam, eroded undulating phase (2-5 percent slopes)	Cc Carlisle silty muck, shallow phase (0-2 percent slopes)	Fc Fox gravelly loam, eroded gently undulating phase (2-5 percent slopes)	Fn Fox silt loam, eroded sloping shallow phase (5-10 percent slopes)	Ga Genesee loam (0-2 percent slopes)	M Made land (variable slopes)	Mk Miami silt loam, severely eroded gently rolling phase (5-10 percent slopes)	Mu Milton silt loam, eroded strongly sloping shallow phase (10-15 percent slopes)	Rd Ross silt loam (0-2 percent slopes)	Wd Warsaw silt loam, gently undulating phase (2-5 percent slopes)	
Bg Bellefontaine silt loam, gently rolling phase (5-10 percent slopes)	Cd Celina silt loam, eroded undulating phase (2-5 percent slopes)	Fd Fox gravelly loam, moderately steep phase (15-35 percent slopes)	Fo Fox silt loam, gently undulating deep phase (2-5 percent slopes)	Gb Genesee silt loam (0-2 percent slopes)	Ma Mahalasville silty clay loam (0-2 percent slopes)	Ml Miami silt loam, severely eroded rolling phase (10-15 percent slopes)	Mv Milton silt loam, gently sloping phase (2-5 percent slopes)	Re Ross silty clay loam (0-2 percent slopes)	We Warsaw silt loam, nearly level phase (0-2 percent slopes)	

Scale 1:24,000

1 0 1 2 Miles

5000 0 5000 10000 Feet

See Sheet No. 1 for Conventional Signs and Diagram showing arrangement of sheets

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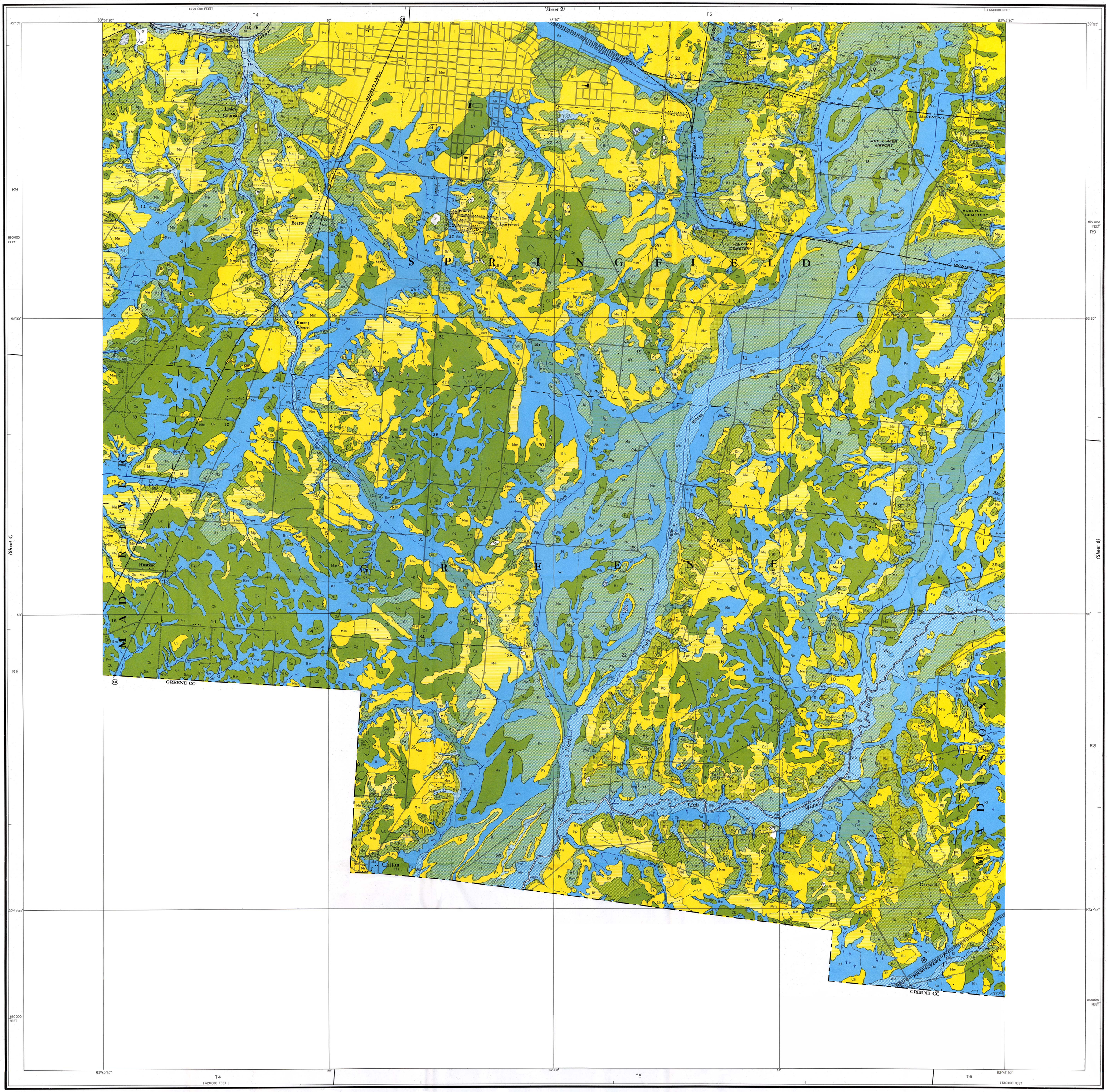
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
CLARK COUNTY–OHIO
SHEET NO. 5

OHIO AGRICULTURAL EXPERIMENT STATION



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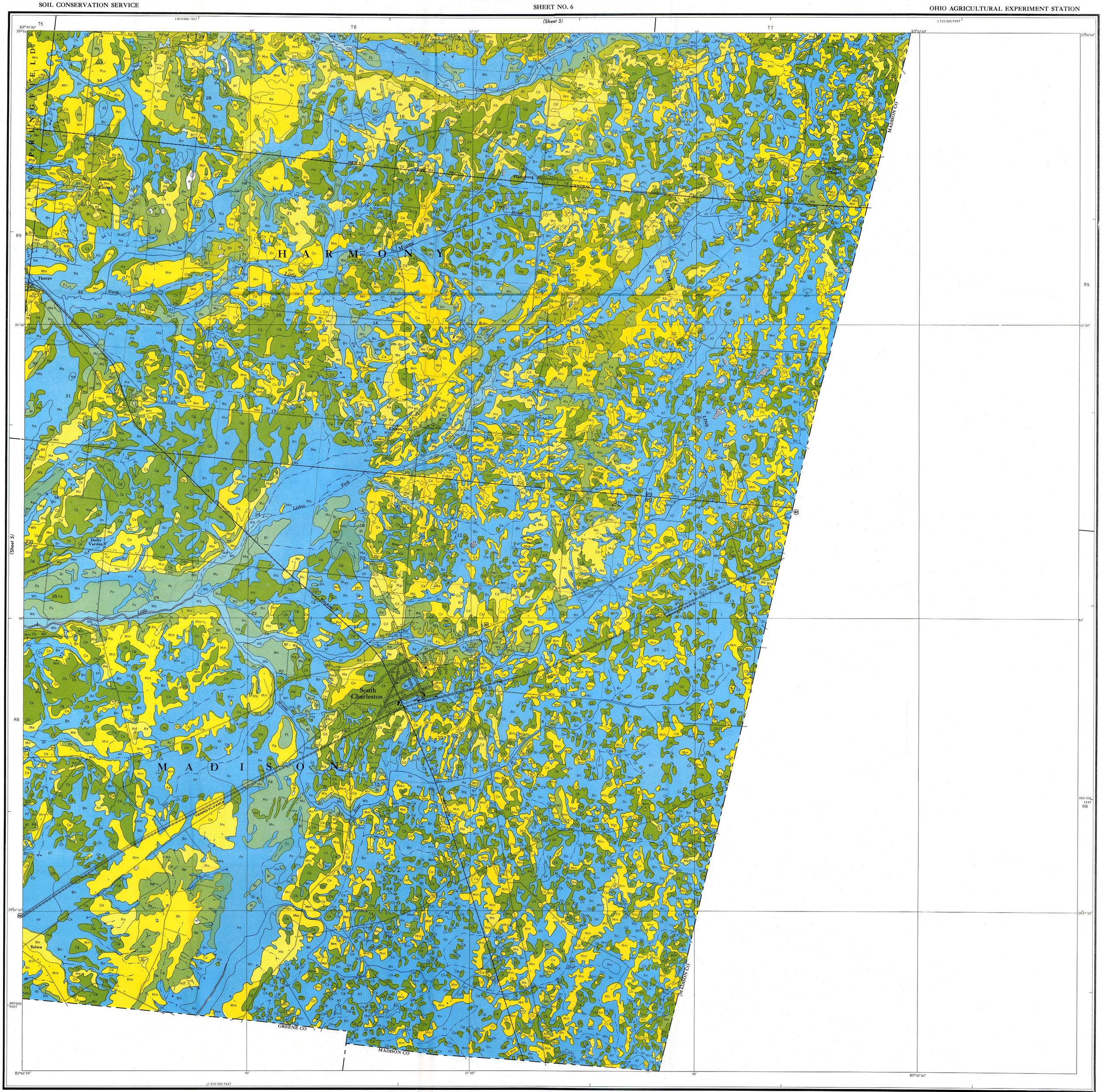
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

CLARK COUNTY–OHIO

SHEET NO. 6

OHIO AGRICULTURAL EXPERIMENT STATION



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Scale 1:24,000

1′ ½ 0 1 2 Miles

5000 0 5000 10,000 Feet

☆ U. S. GOVERNMENT PRINTING OFFICE: 1956 O—380373

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SUPPLEMENT TO THE SOIL MAP OF CLARK COUNTY, OHIO

Soil mapping units (soil types, phases, or land types)	Symbol on map	Dominant slope range	Surface soil [1]		Subsoil [2]		Parent or underlying material	Soil depth [3]	Surface runoff (potential)	Internal drainage	Occurrence of high water table	Moisture supplying capacity	Erosion hazard (by water)	Position on landscape	Workability	Management group [4]
			Color	Consistence (when moist)	Color	Consistence (when moist)										
		Percent														
Abington silty clay loam	AA	0–2	Black	Firm to friable	Gray mottled with yellowish brown.	Very firm	Stratified calcareous gravel-and-sand outwash.	Deep	Very slow	Very slow	Very frequent	Good	None	Terraces	Fair	4
Algiers silt loam	AB	0–2	Grayish brown	Very friable	Black to very dark gray.	Firm	Nearly neutral to calcareous stream alluvium.	Deep	Very slow	Slow	Occasionally flooded.	Good	Overflow	Bottom lands	Excellent	3
Bellefontaine silt loam:																
Undulating phase	BK	2–5	Grayish brown to yellowish brown.	Very friable	Brown to reddish brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately deep	Medium	Medium to rapid	None	Good to fair	Moderate	Uplands	Good	5
Eroded undulating phase	BF	2–5	Brown to yellowish brown.	Friable	Brown to reddish brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately deep	Medium to rapid	Medium to rapid	None	Good to fair	Moderate to high	Uplands	Fair	7
Gently rolling phase	BG	5–10	Yellowish brown to grayish brown.	Very friable	Reddish brown to brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately deep	Rapid to medium	Medium to rapid	None	Fair to good	Moderate to high	Uplands	Fair	8
Eroded gently rolling phase	BE	5–10	Brown to yellowish brown.	Friable	Reddish brown to brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately deep	Rapid	Medium to rapid	None	Fair	High	Uplands	Fair to poor	8
Severely eroded gently rolling phase	BH	5–10	Brown to reddish brown.	Friable to firm	Reddish brown to brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately shallow.	Rapid to very rapid.	Medium to rapid	None	Fair to poor	High	Uplands	Poor	10
Bellefontaine loam and silt loam:																
Rolling phases	BC	10–15	Yellowish brown	Very friable	Reddish brown to brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately deep	Rapid	Medium to rapid	None	Fair	High	Uplands	Good	11
Eroded rolling phases	BB	10–15	Yellowish brown to brown.	Friable	Reddish brown to brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately deep	Rapid	Medium to rapid	None	Fair to poor	High to very high	Uplands	Fair	11
Severely eroded rolling phases	BD	10–15	Brown to reddish brown.	Friable to firm	Reddish brown to brown.	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately shallow.	Very rapid	Rapid to medium	None	Poor to fair	High to very high	Uplands	Fair to poor	11
Eroded hilly phases	BA	15–35	Yellowish brown	Friable	Reddish brown	Firm	Stratified calcareous gravel and sand in moraines and kames.	Moderately shallow.	Very rapid	Rapid to medium	None	Poor to fair	Very high	Uplands	Fair to poor	11
Bronson silt loam	BL	0–2	Dark grayish brown	Very friable	Yellowish brown mottled with grayish brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Slow to very slow	Slow to medium	Occasional	Good	Slight	Terraces	Very good	2
Brookston silty clay loam	BN	0–2	Very dark gray to black.	Friable	Mottled olive yellow and gray.	Firm to very firm	Calcareous glacial till	Deep	Very slow	Very slow	Frequent	Good	Slight	Uplands	Fair to poor	4
Brookston silt loam	BM	0–2	Very dark gray	Friable	Mottled olive yellow and gray.	Firm to very firm	Calcareous glacial till	Deep	Very slow	Very slow	Frequent	Good	Slight	Uplands	Fair	4
Carlisle muck	CA	0–2	Black	Nearly loose	Gray [5]	Firm to very firm	Peat overlying calcareous clay or gravel.	Moderately deep	Very slow to ponded.	Very slow to none	Very frequent	Good (variable)	None	Terraces	Excellent	9
Shallow phase	CB	0–2	Black	Very friable	Gray to light brownish gray.[5]	Firm to very firm	Peat overlying calcareous clay or gravel.	Shallow	Very slow to ponded.	Very slow to none	Very frequent	Good (variable)	None	Terraces	Excellent	9
Carlisle silty muck, shallow phase	CC	0–2	Black	Very friable	Olive gray to gray [6]	Firm to very firm	Peat overlying calcareous clay or gravel.	Moderately shallow.	Very slow to ponded.	Very slow to none	Very frequent	Good (variable)	None	Terraces	Excellent	9
Celina silt loam:																
Undulating phase	CE	2–5	Yellowish brown to grayish brown.	Very friable	Dark yellowish brown slightly mottled with grayish brown.	Firm to very firm	Calcareous glacial till	Moderately deep	Medium to slow	Medium to slow	Occasional	Good	Moderate	Uplands	Good	5
Eroded undulating phase	CD	2–5	Yellowish brown	Friable	Dark yellowish brown slightly mottled with grayish brown.	Firm to very firm	Calcareous glacial till	Moderately deep	Medium	Medium to slow	Occasional	Good	Moderate to high	Uplands	Fair	7
Celina-Crosby silt loams, nearly level phases	CG	0–2	Yellowish brown to grayish brown.	Very friable	Dark yellowish brown slightly mottled with gray.	Firm to very firm	Calcareous glacial till	Moderately deep	Slow	Medium to slow	Occasional	Good	Slight	Uplands	Good	6
Crosby silt loam:																
Nearly level phase	CK	0–2	Grayish brown	Very friable	Mottled yellowish brown, dark grayish brown, and light brownish gray.	Very firm	Calcareous glacial till	Moderately deep	Slow to very slow	Slow	Frequent	Good	Slight	Uplands	Good	6
Gently undulating phase	CH	2–5	Grayish brown	Very friable	Mottled yellowish brown, dark grayish brown, and light brownish gray.	Very firm	Calcareous glacial till	Moderately deep	Medium to slow	Slow	Frequent	Good	Slight to moderate	Uplands	Good to fair	6
Eel silt loam	EA	0–2	Dark to very dark grayish brown.	Very friable	Light brownish gray mottled with olive brown.	Friable	Nearly neutral to calcareous stream alluvium.	Deep	Very slow	Medium to slow	Occasionally flooded.	Good	Overflow	Bottomlands	Excellent	1
Fox silt loam:																
Nearly level phase	FT	0–2	Brown to grayish brown.	Very friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Slow to very slow.	Medium to rapid	None	Good to fair	Slight	Terraces	Excellent	2
Gently undulating phase	FP	2–5	Brown to grayish brown.	Very friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Medium	Medium to rapid	None	Good to fair	Moderate	Terraces	Very good	5
Eroded gently undulating phase	FL	2–5	Brown	Friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Medium	Medium to rapid	None	Good to fair	Moderate to high	Terraces	Good to fair	7
Severely eroded gently undulating phase	FV	2–5	Brown to reddish brown.	Friable to firm	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Medium to rapid	Medium to rapid	None	Fair to good	High	Terraces	Fair to poor	10
Eroded sloping phase	FM	5–10	Brown	Friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Rapid	Medium to rapid	None	Fair	High	Terraces	Fair	8
Severely eroded sloping phase	FW	5–10	Reddish brown	Friable to firm	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Rapid to very rapid.	Medium to rapid	None	Fair to poor	Very high	Terraces	Poor to fair	10
Nearly level deep phase	FS	0– 2	Yellowish brown to grayish brown.	Very friable	Strong brown to brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Very slow to slow	Medium	None	Good	Slight	Terraces	Excellent	2
Gently undulating deep phase	FO	2– 5	Yellowish brown to grayish brown.	Very friable	Strong brown to brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Medium to slow	Medium	None	Good	Moderate	Terraces	Very good	5
Nearly level shallow phase	FU	0– 2	Brown to dark brown.	Very friable	Dark reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately shallow.	Slow to very slow	Rapid to medium	None	Fair	Slight	Terraces	Good	2
Gently undulating shallow phase	FR	2– 5	Brown to dark brown.	Very friable	Dark reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Medium to slow	Rapid to medium	None	Fair	Moderate	Terraces	Good	5
Eroded sloping shallow phase	FN	5–10	Brown	Friable	Dark reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Rapid to medium	Rapid to medium	None	Fair to poor	High	Terraces	Fair	10
Fox fine sandy loam:																
Nearly level phase	FB	0– 2	Yellowish brown or brown.	Very friable	Strong brown	Firm to friable	Stratified calcareous sand-and-fine gravel outwash.	Moderately deep	Slow	Medium to rapid	None	Fair to good	Slight	Terraces	Excellent	2
Gently undulating phase	FA	2– 5	Yellowish brown or brown.	Very friable	Strong brown	Firm to friable	Stratified calcareous sand-and-fine gravel outwash.	Moderately deep	Medium	Medium to rapid	None	Fair to good	Moderate to slight.	Terraces	Very good	5
Fox gravelly loam:																
Eroded sloping phase	FE	5–10	Brown to dark brown.	Friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately shallow.	Rapid	Rapid	None	Fair to poor	High	Terraces	Fair to poor	10
Eroded gently undulating phase	FC	2– 5	Brown to dark brown.	Friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately shallow.	Rapid	Rapid	None	Poor to fair	Moderate to high	Terraces	Fair	7
Severely eroded sloping phase	FG	5–10	Brown to reddish brown.	Friable to firm	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Shallow	Rapid to very rapid.	Rapid	None	Poor	High to very high.	Terraces	Poor	10
Eroded strongly sloping phase	FF	10–15	Brown to reddish brown.	Friable to firm	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Shallow	Very rapid	Rapid	None	Poor	High to very high.	Terraces	Poor	11
Moderately steep phase	FD	15–35	Dark brown to brown.	Friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Shallow	Very rapid	Rapid	None	Poor	High to very high	Terraces	Fair to poor	11
Fox loam:																
Gently undulating phase	FH	2–5	Brown to yellowish brown.	Very friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Medium	Medium to rapid	None	Good to fair	Moderate	Terraces	Excellent	5
Nearly level phase	FK	0–2	Yellowish brown to brown.	Very friable	Reddish brown	Firm	Stratified calcareous gravel-and-sand outwash.	Moderately deep	Slow	Medium to rapid	None	Good to fair	Slight	Terraces	Very good	2
Genesee silt loam	GB	0–2	Brown to dark grayish brown.	Very friable	Dark grayish brown	Friable	Nearly neutral to calcareous stream alluvium.	Deep	Very slow	Medium	Occasionally flooded.	Good	Overflow	Bottom lands	Excellent	1
Genesee loam	GA	0–2	Brown to grayish brown.	Very friable	Grayish brown	Friable	Nearly neutral to calcareous stream alluvium.	Deep	Slow to very slow	Medium	Occasionally flooded.	Good	Slight overflow	Bottom lands	Excellent	1
Homer silt loam	HA	0–2	Dark grayish brown to light brownish gray.	Very friable	Mottled yellowish brown and olive gray.	Firm to very firm	Stratified calcareous gravel-and-sand outwash.	Deep	Very slow	Slow to very slow	Frequent	Good	Slight	Terraces	Good to fair	6
Kendallville silt loam:																
Undulating phase	KE	2–5	Grayish brown to brown.	Very friable	Brown to reddish brown.	Firm	Calcareous glacial till with lenses of gravel and sand.	Moderately deep	Medium	Medium	None	Good	Moderate	Uplands	Good	5
Eroded undulating phase	KB	2–5	Brown	Friable	Brown to reddish brown.	Firm	Calcareous glacial till with lenses of gravel and sand.	Moderately deep	Medium to rapid	Medium	None	Good	Moderate to high	Uplands	Fair	7
Gently rolling phase	KC	5–10	Brown to grayish brown.	Very friable	Reddish brown to brown.	Firm	Calcareous glacial till with lenses of gravel and sand.	Moderately deep	Rapid to medium	Medium	None	Good to fair	Moderate to high	Uplands	Fair to good	8
Eroded gently rolling phase	KA	5–10	Yellowish brown to brown.	Friable	Reddish brown to brown.	Firm	Calcareous glacial till with lenses of gravel and sand.	Moderately deep	Rapid	Medium	None	Fair to good	High	Uplands	Fair to poor	8
Severely eroded gently rolling phase	KD	5–10	Brown to yellowish brown.	Friable to firm	Reddish brown to brown.	Firm	Calcareous glacial till with lenses of gravel and sand.	Moderately deep	Very rapid	Medium	None	Fair	Very high	Uplands	Poor	10
Kokomo silty clay loam	KF	0–2	Black	Friable to firm	Dark gray mottled with olive and dark olive gray.	Very firm	Calcareous glacial till	Deep	Very slow to ponded.	Very slow	Frequent	Good	None	Uplands	Fair to poor	4
Made land	M															12
Mahalasville silty clay loam	MA	0–2	Dark gray to very dark gray.	Friable to firm	Grayish brown mottled with dark gray and yellowish brown.	Very firm	Calcareous silts, fine sands, and pebbles over gravel and sand.	Deep	Very slow	Very slow	Frequent	Good	None	Terraces	Fair to poor	4
Miami silt loam:																
Undulating phase	MM	2–5	Light yellowish brown to yellowish brown.	Very friable	Brown to yellowish brown.	Firm	Calcareous glacial till	Moderately deep	Medium	Medium	None	Good	Moderate	Uplands	Good	5
Nearly level phase	MH	0–2	Light yellowish brown to yellowish brown.	Very friable	Brown to yellowish brown.	Firm	Calcareous glacial till	Moderately deep	Slow	Medium	None	Good	Slight	Uplands	Good to very good	2
Eroded undulating phase	ME	2–5	Yellowish brown to brown.	Friable	Brown to yellowish brown.	Firm	Calcareous glacial till	Moderately deep	Medium to rapid	Medium	None	Good	Moderate to high	Uplands	Fair	7
Gently rolling phase	MF	5–10	Light yellowish brown to yellowish brown.	Friable	Brown to yellowish brown.	Firm	Calcareous glacial till	Moderately deep	Rapid to medium	Medium	None	Good to fair	Moderate to high	Uplands	Fair to good	8
Eroded gently rolling phase	MB	5–10	Yellowish brown	Friable	Brown to yellowish brown.	Firm	Calcareous glacial till	Moderately deep	Rapid	Medium	None	Fair to good	High	Uplands	Fair to poor	8
Severely eroded gently rolling phase	MK	5–10	Yellowish brown to brown.	Friable	Brown to yellowish brown.	Firm to friable	Calcareous glacial till	Moderately deep	Very rapid	Medium	None	Fair	Very high	Uplands	Poor	10
Eroded rolling phase	MD	10–15	Yellowish brown	Friable	Brown to reddish brown.	Firm	Calcareous glacial till	Moderately deep	Very rapid	Medium to rapid	None	Fair	Very high to high	Uplands	Poor to fair	11
Severely eroded rolling phase	ML	10–15	Yellowish brown to brown.	Friable to firm	Brown to reddish brown.	Firm	Calcareous glacial till	Moderately shallow.	Very rapid	Medium to rapid	None	Fair to poor	Very high	Uplands	Poor to very poor	11
Hilly phase	MG	15–35	Yellowish brown	Friable	Brown to reddish brown.	Firm	Calcareous glacial fill	Moderately shallow.	Very rapid	Medium to rapid	None	Fair	Very high	Uplands	Poor to fair	11
Eroded hilly phase	MC	15–35	Yellowish brown to brown.	Friable	Brown to reddish brown.	Firm	Calcareous glacial till	Moderately shallow.	Very rapid	Medium to rapid	None	Poor	Very high	Uplands	Poor	11
Mill Creek silt loam:																
Nearly level phase	MO	0– 2	Grayish brown to dark grayish brown.	Very friable	Yellowish brown	Firm	Calcareous, poorly assorted (dirty) gravel-and-sand outwash.	Deep	Slow	Medium	None	Good	Slight	Terraces	Excellent	2
Gently undulating phase	MN	2– 5	Grayish brown	Very friable	Yellowish brown	Firm	Calcareous, poorly assorted (dirty) gravel-and-sand outwash.	Deep	Medium to slow	Medium	None	Good to fair	Moderate	Terraces	Very good	5
Millsdale silty clay loam	MP	0– 2	Black to very dark gray.	Friable to firm	Dark gray mottled with olive and light yellowish brown.	Firm to very firm	Shallow calcareous till over limestone bedrock.	Moderately deep	Very slow	Very slow	Frequent	Good	None	Uplands	Fair to poor	4
Milton silt loam:																
Gently sloping phase	MV	2– 5	Yellowish brown	Friable	Dark yellowish brown to reddish brown.	Firm to very firm	Shallow calcareous till over limestone bedrock.	Moderately deep	Medium	Medium	None	Good	Moderate	Uplands	Good	5
Nearly level phase	MX	0– 2	Yellowish brown	Friable	Dark yellowish brown to reddish brown.	Firm to very firm	Shallow calcareous till over limestone bedrock.	Moderately deep	Slow	Medium	None	Good	Slight	Uplands	Excellent	2
Eroded gently sloping phase	MR	2– 5	Yellowish brown to brown.	Friable	Dark yellowish brown to reddish brown.	Firm to very firm	Shallow calcareous till over limestone bedrock.	Moderately deep	Medium to rapid	Medium	None	Good to fair	Moderate to high.	Uplands	Fair to poor	7
Eroded sloping phase	MS	5–10	Yellowish brown to brown.	Friable	Dark yellowish brown to reddish brown.	Firm to very firm	Shallow calcareous till over limestone bedrock.	Moderately deep	Rapid	Medium	None	Fair to good	High	Uplands	Poor	8
Severely eroded sloping phase	MT	5–10	Brown	Friable to firm	Dark yellowish brown to reddish brown.	Firm to very firm	Shallow calcareous till over limestone bedrock.	Moderately deep	Very rapid	Medium	None	Fair	Very high	Uplands	Very poor	10
Eroded strongly sloping shallow phase	MU	10–35	Yellowish brown to brown.	Friable	Brown to yellowish brown.	Friable	Very shallow (or none) calcareous drift over limestone bedrock.	Shallow	Rapid to very rapid.	Rapid	None	Poor to fair	Very high	Uplands	Poor to very poor	11
Gently sloping shallow phase	MW	2–5	Yellowish brown to brown.	Friable	Reddish brown to brown.	Firm to friable	Very shallow calcareous drift over limestone bedrock.	Shallow	Medium	Rapid to medium	None	Fair	Moderate	Uplands	Fair to poor	11
Eroded sloping shallow phase	MT	5–10	Brown	Friable	Reddish brown to brown.	Firm to friable	Very shallow calcareous drift over limestone bedrock.	Shallow	Rapid	Rapid	None	Fair to poor	High	Uplands	Poor to fair	11
Needham silty clay loam	NA	0–2	Black	Friable to firm	Gray mottled with yellowish brown.	Firm to very firm	Calcareous silts, fine sands, and pebbles over gravel and sand.	Deep	Very slow	Very slow	Frequent	Good	None	Terraces	Fair to poor	4
Randolph silt loam	RA	0–2	Grayish brown to dark grayish brown.	Very friable	Mottled dark brown and light olive brown.	Firm	Shallow calcareous glacial drift over limestone bedrock.	Moderately deep	Slow	Slow	Occasional	Good	Slight	Uplands	Good to fair	6
Rodman gravelly loam:																
Eroded steep phase	RC	15–35	Dark brown	Loose	---(6)---	Loose	Stratified calcareous gravel and sand.	Very shallow	Rapid	Very rapid	None	Poor	High	Uplands and terraces.	Fair to poor	12
Eroded sloping and strongly sloping phases	RB	10–15	Dark brown to brown.	Loose	---(6)---	Loose	Stratified calcareous gravel and sand.	Very shallow	Rapid	Very rapid	None	Poor	High	Uplands and terraces.	Fair to poor	11
Ross silty clay loam	RE	0–2	Very dark brown	Friable	Very dark brown	Friable	Nearly neutral to calcareous stream alluvium.	Moderately deep	Very slow	Medium	None	Good	None	Bottom lands	Good	1
Ross silt loam	RD	0–2	Very dark brown	Friable	Dark brown	Friable	Nearly neutral to calcareous stream alluvium.	Moderately deep	Very slow	Medium	None	Good	None	Bottom lands	Excellent	1
Shoals silt loam	SA	0–2	Dark grayish brown	Friable	Mottled gray, yellowish brown, and dark gray.	Friable	Nearly neutral to calcareous stream alluvium.	Deep	Very slow	Slow	Occasionally flooded.	Good	Overflow	Bottom lands	Very good	3
Sloan silty clay loam	SC	0–2	Very dark gray to black.	Firm to friable	Very dark grayish brown mottled with olive brown.	Firm	Nearly neutral to calcareous stream alluvium (relatively old).	Deep	Very slow	Very slow	Occasionally flooded.	Good	Overflow	Bottom lands	Fair to poor	3
Sloan silt loam	SB	0–2	Very dark gray	Friable	Very dark grayish brown mottled with olive brown.	Firm	Nearly neutral to calcareous stream alluvium (relatively old).	Deep	Very slow	Very slow	Occasionally flooded.	Good	Overflow	Bottom lands	Fair	3
Steep land-limestone outcrop	SD	15–35+	Variable	Friable	Variable	Friable	Predominantly limestone bedrock.	Very shallow	Very rapid	Very rapid	None	Poor	High to very high	Uplands	Poor to very poor	12
Wabash silty clay loam	WB	0–2	Black to very dark gray.	Firm to friable	Mottled dark gray and very dark gray.	Firm	Nearly neutral or calcareous stream alluvium (relatively old).	Deep	Very slow	Very slow	Occasionally flooded.	Good	Overflow	Bottom lands	Fair to poor	3
Wabash silt loam	WA	0–2	Very dark gray to black.	Friable	Mottled dark gray and very dark gray.	Firm	Nearly neutral or calcareous stream alluvium (relatively old).	Deep	Very slow	Very slow	Occasionally flooded.	Good	Overflow	Bottom lands	Fair	3
Warners loam	WC	0–5	Very dark gray	Very friable	Light gray	Friable	Organic remains over marl or travertine.	Shallow	Slow to medium	Very slow	Frequent	Good	None	Terraces	Good to fair	9
Warsaw silt loam:																
Nearly level phase	WE	0–2	Very dark brown	Very friable	Brown to reddish brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Slow	Medium	None	Good	Slight	Terraces	Excellent	2
Gently undulating phase	WD	2–5	Very dark brown	Very friable	Brown to reddish brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Medium	Medium	None	Good to poor	Moderate	Terraces	Very good	5
Wawaka silt loam	WF	0–2	Grayish or yellowish brown.	Very friable	Brown	Firm	Calcareous glacial till	Moderately deep	Slow	Medium	None	Good	Slight	Uplands	Very good	2
Westland silty clay loam	WH	0–2	Very dark gray	Friable to firm	Mottled grayish brown, very dark gray, and yellowish brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Very slow	Very slow	Frequent	Good	None	Terraces	Fair to poor	4
Westland silt loam	WG	0–2	Very dark gray	Friable	Mottled grayish brown, very dark gray, and yellowish brown.	Firm	Stratified calcareous gravel-and-sand outwash.	Deep	Very slow	Very slow	Frequent	Good	None	Terraces	Fair	4

[1] The 6- to 9-inch plow layer.
[2] The B horizon, beneath the surface soil and subsurface soil. In some cases this horizon is in the lower part of the subsoil.
[3] Depth classes are as follows: Very shallow, 0 to 10 inches; shallow, 10 to 20 inches; moderately shallow, 20 to 30 inches; moderately deep, 20 to 40 inches; and deep, 40 inches +.
[4] See section, Use and Management of Soils.
[5] Clay.
[6] Has no developed subsoil.